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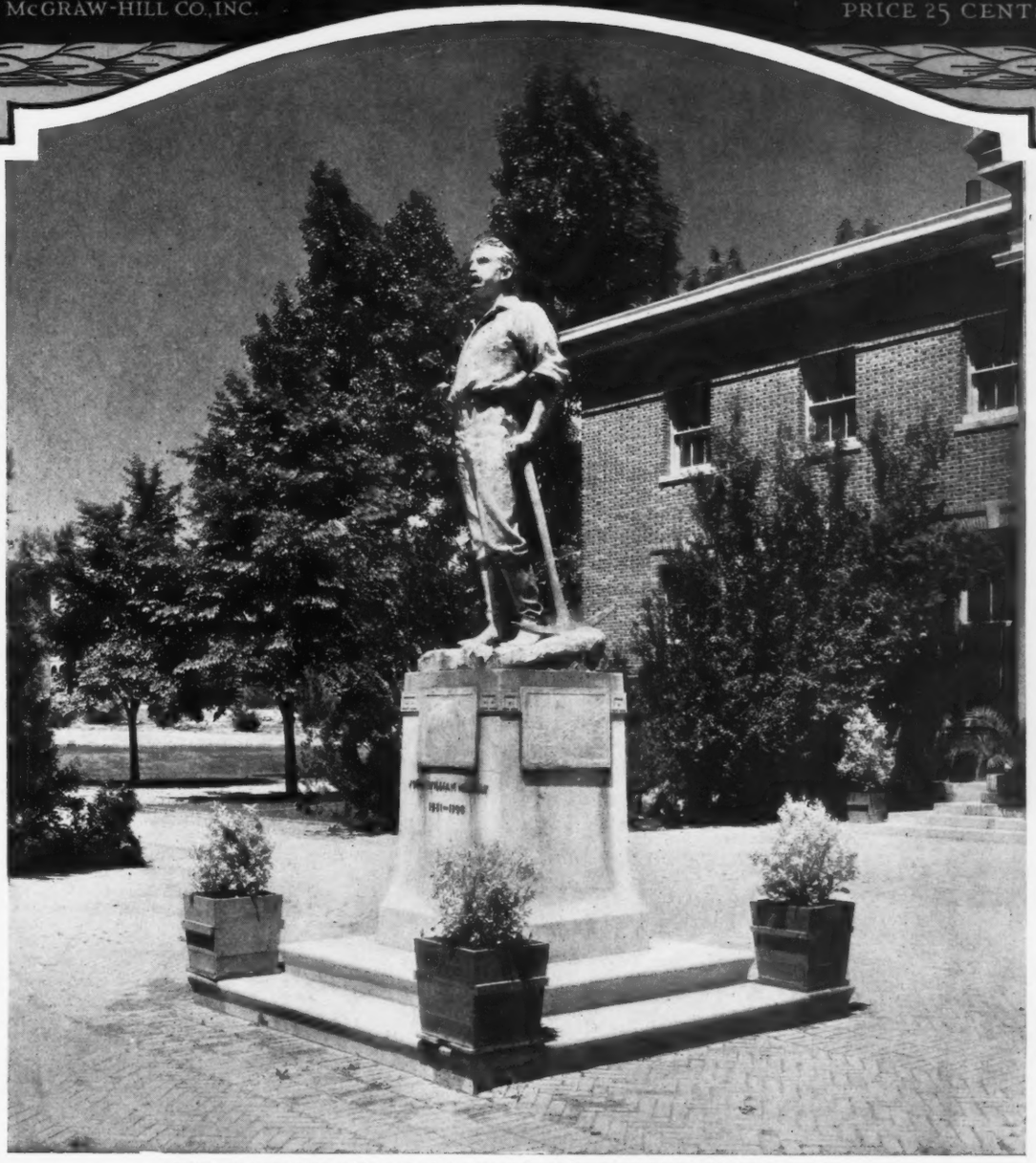


Statue of John William Mackay, of Comstock fame, Mackay School of Mines, Reno, Nevada

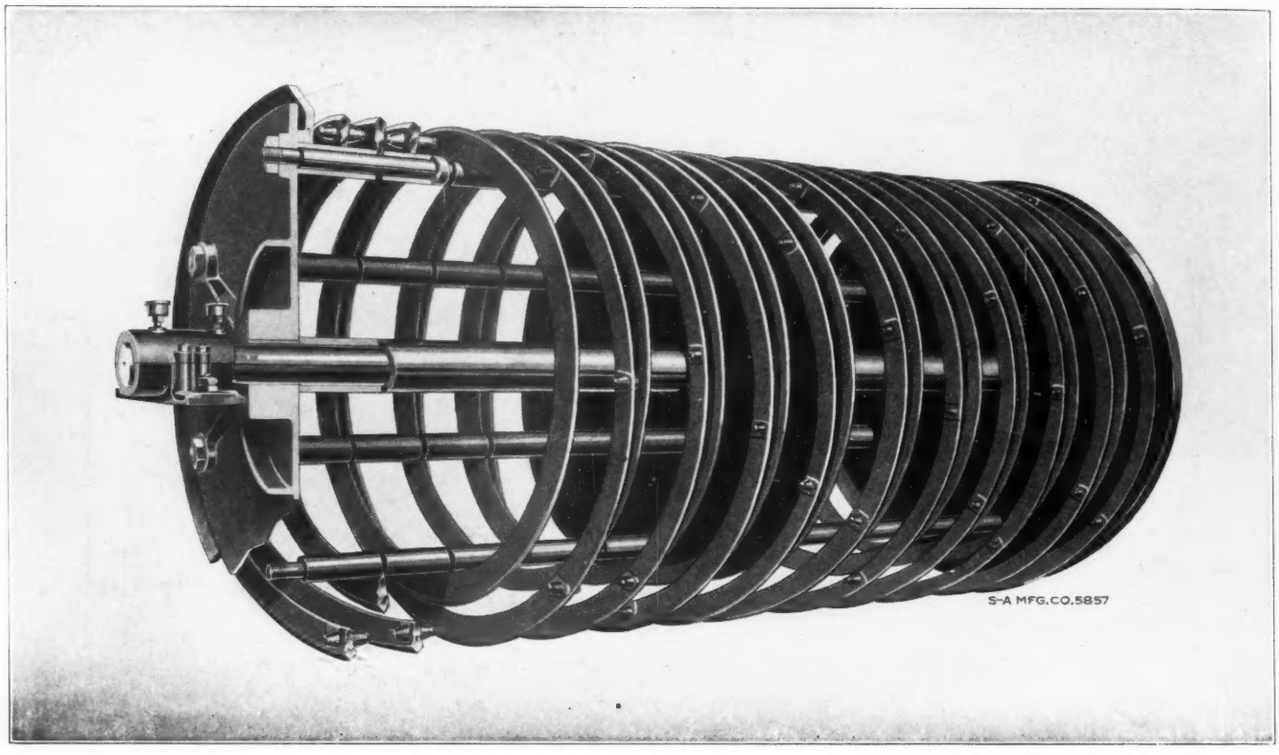
Roping Pack Loads, *By John Kruttschnitt* — Milling Manganese Ore at Algonquin Mine, Philipsburg, Mont., *By Richard V. Ageton* — Gold Mining in Eastern Siberia, *By F. L. Cole* Copper Leaching in Australia, *By H. R. Sleeman* — Biography of E. J. Horwood

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

August 4, 1923

BURCH Grizzly

A new non-clogging grizzly—



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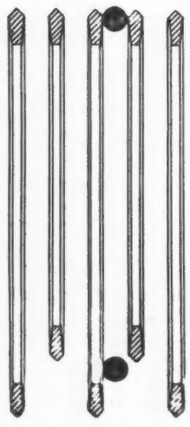
Uniform spacing of the rings for accurate separation and increased openings for easy passage of fines.



A Ring Type Grizzly That Will Not Clog

The over-size is carried over on top the rings. The fines pass thru

Where fines are to be separated from the product that goes to the crusher, the Burch Grizzly is right in its element. The Grizzly will carry over the lumps to the crusher and allow the fines to be by-passed.

This Grizzly was invented by H. Kenyon Burch, prominent Mining Engineer.

Built in three standard diameters, 36, 48 and 60 inches and in any width up to 10 feet. The ring spacing can be constructed to suit the requirements.

STEPHENS-ADAMSON MFG. CO., AURORA, ILLINOIS

ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 116 **New York, August 4, 1923** *Number* 5

Burying the Hatchet in Colorado

ONE OF THE GRATIFYING THINGS about present-day mining in Colorado is the cordial relation existing between miners and smelters. Such a state of affairs is normal and would occasion no particular comment were it not for the fact that Colorado's early mining history is replete with stories of strained industrial feelings. Today's conditions are in pleasing contrast. It is not unusual for the interested visitor to the state to hear unsolicited complimentary references to the attitude of the smelters from various mining-company officials operating in many of Colorado's mining districts. Inasmuch as smelting operations in the state are now in the hands of one large company—the American Smelting & Refining Co. —this feeling of the miners toward the smelters must be especially pleasing to the officials of that influential organization. But it would be unfair, however, to limit the regard of the miners to the smelting company alone. A few smaller organizations also handle ores produced in the state, but they have never been the power that their larger colleague has been. Nevertheless, they are entitled to their share of credit for the changed conditions.

It is not difficult to account for the new attitude of these two important factors in Colorado's metal production. For several years the metal output of the state has been decreasing. Several smelter units of the A. S. & R. have had to close down for lack of an adequate ore supply—an excellent commentary, though a sad one, of the dependence of smelting upon a healthy mining industry. Something had to be done to stimulate Colorado's metal-mining activity. Evidently, the smelting company realized that it could not adopt a *laissez-faire* policy and abandon the mining companies to their own limited resources and expedients, for in the past few years it has taken an active part in some of the most important mining developments of the state.

A few samples will suffice: In Leadville the A. S. & R. is partner to an enterprise having for its object the unwatering of Iron Hill and the reviving of mining operations in that part of the city. It is also aiding financially the driving of the Canterbury tunnel. In Durango it has built a "sulphate" plant in order to test on a large scale the new "sulphate," better known as the Coolbaugh process for treating complex zinc-lead ore. In Bonanza it has helped finance the old Rawley mine.

Doubtless the presence of some new western blood on the directorate of the company has had something to do with the policy it has adopted. Also, some sound common sense, for it is obvious that the smelting company has a heavy investment in Colorado and that it stands to gain by any improvement in the mining industries. The present situation also reflects considerable credit upon the smelter officials whose duty it is to establish contact in the field with the various mining companies supplying them with ore.

Another element in the situation has been the work of a virile State Metal Mining Association, which is representative of both small and large operators in the state. The association has ever been ready to champion the rights of the mining industry and has done its job smoothly and well. The old and familiar cry that the smelters are unreasonable in their charges will probably never disappear so long as there is any mining and smelting done on the continent, but a desire to remove even this most potent source of friction is seen in the action of the smelting company, which we have learned has opened its books when necessary to convince a miner of the fairness of its charges.

These are indeed steps forward. They should have been taken years ago, but that is water that has gone under the bridge. The investigation that was conducted several years ago by the Colorado State Legislature into the activities of the A. S. & R. also did much to clear the skirts of the smelting company, for it disclosed no inordinate profits from local smelting. Present relations between miners and smelters and the spirit of conciliation shown augur well for Colorado's mining future.

How Old Is Your Ore?

THE ORE IN YOUR MINE was deposited at a certain definite geologic period and has remained in the earth quiescent, waiting—first for erosion to bring it to or near the surface, second for you to dig it out before erosion does so. Eventually erosion would probably do it if you did not, and would scatter it in the sands of the rivers and the ocean, and dissolve it in the seas.

How long has it waited for you? That depends—in practically every case, probably, millions of years —nothing less. Your ore may be the result of an epoch of ore deposition in the Tertiary, the Cretaceous, or the Cambrian, and so may be, let us say, thirty, ninety, or six hundred million years old. Or, it may be —if you are mining Canadian ores, for example— pre-Cambrian, in which case it is much older. The late Dr. Joseph Barrell, of Yale, observed that the record of radioactivity of certain minerals in the pre-Cambrian indicated a minimum age of 1,400 million years, back of which, he observed, we are frankly and simply face to face with the unknown.

"Way down in Tennessee" the president of the University of Tennessee, and the politicians back of him, some time ago dismissed certain professors of science because they taught things which they—the politicians —had never heard of and therefore, of course, could not be true. "Evolution" was the war cry on which they based their campaign against research, science, and logic; although they had no more idea of what evolution might mean than if it were the Arabic equivalent. Now they have dismissed a large part of the rest of the faculty. Next term they will be in good shape for starting a sound educational program, with the axiom

that the earth and the sun and the stars were created in 4,004 B. C. at half past ten in the morning.

One is often aghast at the stupid way in which human affairs are run. But if one inspects and cogitates over the immense majority, and their witlessness and stubbornness, one is finally amazed that the world is as well administered as it is. The intelligent and benevolent minority have in the last analysis more influence than might be suspected. Such anti-educational "education" as the Tennesseans are proposing will create a wide gulf between institutions like theirs and true universities like Yale and Columbia; and the demonstration they give of their simian intellects goes far to strengthen what they conceive to be the theory of evolution.

The Hidden Mines

PROSPECTING in many settled countries has not gone so far as it has in the more exposed mountains of the Western United States. In those regions which are covered by some blanket of soil or thick vegetation which conceals the bedrock, the prospector or geologist has no clue to the possible occurrence of ores beneath. Possibly electrical methods of determination may reveal the existence of large masses of iron or pyrite ores under such soil coverings, as was done in at least one instance in Sweden, during the war; but ordinarily detection of ores in such cases will be difficult. In the regions of North America which are covered by glacial drift, lakes, and moss, there will be possibilities of new discoveries for generations to come. Such is also the case in tropical regions, where there is usually a heavy covering of soil and of thick vegetation. A correspondent in Japan writes that the thick covering of bamboo in the mountains has effectually hindered the prospector in that country, and although mining has gone on for centuries, several important copper mines of the porphyry type have been discovered within the last decade. Even in the Western United States, where the mountains have been fairly well prospected, what of the deposits which lie under the mantle of "wash" between the desert ranges? Eventually prospecting methods will take note of the difficulties in finding the blanketed orebody, and methods to decrease the labor of searching will be devised. Meanwhile, there is always the chance that a tiny outcrop discovered on a lake margin, or the rock beneath an uprooted tree, or a well driven for water, or a railroad cut, or one of the many other such accidental observations, may lead to the discovery of a new and valuable mine.

"The Old Order Changeth"

RECENT political and economic events afford little reason for thinking that the world is returning to what President Harding, after consulting the dictionary, called a state of normalcy. European conditions seem to be just as unsettled as they have been for the last ten years. Too many are out of work in England, and Premier Baldwin's ideas on the settlement of Continental difficulties do not seem to be meeting any large amount of international acceptance. France has seized the Ruhr and does not yet know whether she will get much profit therefrom or not; she is determined to put Germany in her place regardless of what other nations may think, but she does not know just how to go about it without assistance. Germany is waiting to see what the so-called victorious Allies are going to do about her, her industrialists meanwhile having ravaged the country and secreted most of her tangible resources, with which reparation debts might have been paid, in other countries where they are thought to be safe.

Russia seems to have attained a stable government, even if a radical one; as autocratic as in the days of the Czar but with a different group in control. The Communists are a minority of the population, but they insist on having their way in all things. Religious interests, they think, are inclined to be too anxious for a share in political government, so religion will be abolished, according to the Soviet program.

China does not seem to have made much of a success of the republican form of government, and there is a considerable difference of opinion as to where the seat of government, if any, really is. In our own country, one Magnus Johnson takes off his overalls, and brushes the hayseed from his neck, to accept election to the United States Senate. He does not know just what he is going to do there, but at any rate will do his best to upset the established order of things and follow the radicals. The "Wobblies" are on the road again, and recently threatened to swoop down upon the peaceful citizens of Port Arthur, Tex. The Ku Klux Klan is sweeping the country and finding an all too general acceptance of its theory that further progress by the Negroes, Jews, and Catholics is a national menace. The country is somewhere near equally divided as to whether the evils of drink do or do not offset the enjoyment to be derived therefrom, with each side strongly partizan and intolerant of all arguments offered by the other. The stringent laws that have been passed to enforce prohibition are openly violated. Henry Ford, a successful manufacturer of cheap automobiles, a promulgator of radical ideas, some very good and some very bad—a gentleman with no knowledge of political or economic history—is far and away the leading choice of the people for the next president of the United States, according to a poll taken by *Colliers*.

The men who have had charge of the world's destinies during the last ten years have blundered, and the people want a change. They blundered when they plunged the world into a murderous war, they blundered in making the peace treaty, and now, five years after the close of the war, they are as disagreed as ever about what is to be done. The people want a new sort of men to be in charge of affairs; they do not know just what kind they want, except that they must be opposed to the old order. The copper miner wants conditions adjusted so that he can get more than 14½c. for copper when his dollar is worth, according to Irving Fisher, 63c. The farmer is also discontented, and rightly so, when he can get only 75c. a bushel for his wheat. The man of small income and less wealth feels the injustice of the fact that he, a virtuous and hard-working man, has nothing, whereas the Rockefeller family has several billions, Ford and Mellon have possibly five hundred million apiece, and the term "millionaire" has ceased to be distinctive.

Out on Long Island a four-track railway is being built over ground where there were but two tracks before. The daily swarm of commuters is being shifted over precarious sand piles and around casual corners with grinding switches, and yet one gets to his destination almost on time. Simeon Strunsky tells about it in a recent *New York Evening Post*. "The engineer, the mason, and the concrete mixer deserve the posthumous

credit they are in for," says Mr. Strunsky, "and especially the engineer. . . . Perhaps that is what people mean when they want the engineers to tackle the job of world reconstruction. If anybody can somehow manage to keep the old world going while building a new one under its feet it ought to be the engineers."

We do not know whether or not the engineers will play a very large part in the reconstruction of the world. We have one notable representative in the curious mixture of ability and mediocrity which President Harding has assembled for a Cabinet. And possibly Mr. Ford may be termed an engineer. But engineers do not seem to be leading in the kind of thought the people now demand. They are a rather conservative lot, on the whole, whereas the requirements are for something radical.

Grabbing the Credit

A MOMENTOUS REORGANIZATION of a government department is indicated in press bulletins that the department is sending out from Washington. Engineers, geologists, and the like, formerly designated as of the Geological Survey, or the Bureau of Mines, of the Department of the Interior, are now referred to as engineers and geologists of the Department of the Interior in its Geological Survey or Bureau of Mines. Likewise, reports formerly issued "by the Bureau, or the Survey, of the Department" are now issued "by the Department through its Bureau or Survey." This change is plainly a weighty matter. Evidently, the Secretary believes that good business requires that a department head shall get the credit for his department's work. Possibly in the past the directors of the Bureau and of the Survey have shone too brilliantly. If so, their refulgence should be dimmed, so that the little light of the Secretary who has come out of Colorado may be visible.

Salvage in the Oil Fields

RECENTLY a petroleum engineer of the Bureau of Mines has undertaken to gather data for a bulletin on salvages in the oil industry. He should easily find ample material for a long discussion of the subject. Wastefulness is a glaring fault of many operators, especially among the smaller companies. Supplies are used with a lavish hand and are often scrapped when only minor repairs are needed. The scrap pile is worth investigating.

There are two types of superintendents for oil field operations: one is the man who can make things hum in boom times when big production is being obtained and who uses labor and supplies as if their cost was nothing; the other is the superintendent who considers cost in planning the daily work and who is the more valuable of the two when flush times are over and careful saving is necessary. Oftentimes the former disdains the latter's methods and will not be hampered by cost restrictions and as a result may cause his company loss.

Extravagance and spendthrift habits are characteristics of the newly rich, and no doubt the spectacle of the "flood of liquid wealth," as a promoter might call it, induces recklessness on the part of the employees. Some of the larger companies have given careful attention to the work of salvaging supplies, and their example can well be followed to advantage.

Minimum Capital Input in Mining Enterprises

LAVISH USE OF CAPITAL in mining enterprises is a source of waste. Its most direct result is to increase the overhead or general expense and to handicap operations. The operating personnel may be all that can be desired, but their utmost endeavors cannot compensate for disproportionate capitalization, or wasteful capital input in mining development and metallurgical plants.

Optimism is a fine thing in the initial stages of a mining enterprise, but it should be tempered with business shrewdness which must satisfy itself upon the intrinsic merit of the enterprise and then put the brakes wisely but firmly upon the money outgo necessary to bring the enterprise to the producing stage. Alternative methods of mine development should be subjected to intensive study by estimating the cost of each and comparing the advantages and disadvantages.

The proposed scale of operations is another factor that merits careful consideration after the extent of the orebody has been reasonably determined. Likewise, the method of ore treatment should be conclusively investigated.

These critical points necessitate balancing in a definite plan by an engineer who is thoroughly competent by experience and training to visualize the project as a whole. This is not so easily done, but upon it depends the judicious expenditure of capital and a considerable part of the success of the enterprise.

A Dinner Spoiled

ROCKS in the road to fortune were encountered the other day by the Sinaloa Exploration & Development Co., and at a most inopportune moment. It is never pleasant to go on the rocks, but the degree of discomfort depends on the circumstances. This was a most inauspicious occasion. The stockholders—some of them—were just about to dine at the company's expense at a leading hotel in New York, and by way of exchange of courtesies were discussing how more money might be raised to equip the company's properties further—a most laudable thing for stockholders to do—when in popped a representative of the Attorney General with an injunction forbidding the company temporarily to sell further stock in its enterprise. Fraudulent practice in selling $700,000 worth of stock was alleged, including the issuance of misleading advertisements and prospectuses containing glowing promises as to enormous dividends.

The company's activities had been investigated by the Better Business Bureau of New York City, whose affidavit figured in the affair. This organization is doing an excellent and much needed work in uncovering fraudulent promotions, though it has only scratched the surface. The impudence of crooked promoters is in the main due to the almost complete immunity they have enjoyed. Investigation and publicity, followed by prosecution, will make them less effective.

"Journal-Press" Index Ready

THE INDEX of Vol. 115 of the *Engineering and Mining Journal-Press* for the first half of the year 1923 is now ready for distribution and will be sent to all requesting it. A post card will do.

Engineers of Note

EDWARD JAMES HORWOOD

IT IS FITTING that an engineer who has played an important part in conducting the affairs of one of the largest industrial enterprises in Australia should be an Australian born and bred. E. J. Horwood, the present superintendent of mines of the Broken Hill Proprietary Co., Ltd., was born at Bendigo, Victoria, in 1864 and received his preliminary education at the Bendigo High School and School of Mines. Upon graduation he was employed for twelve months in the drafting office of the Bendigo Iron Works, owned by his father, the late Joel Horwood. Here he obtained further experience in the design and construction of machinery. Subsequently he attended the Melbourne University and eventually was graduated as a mining and civil engineer, obtaining the degree of M.C.E. in 1885. From 1885 to 1887 he was employed as contractor's engineer by railway contractors in Victoria and later on the construction of the last 150-mile section of the South Australian railway to Broken Hill. The work done during this period was on the Silverton Tramway and Tarrawingee Co.'s line.

EDWARD JAMES HORWOOD

Early in 1888 Mr. Horwood set up in private engineering practice at Broken Hill with A. I. Creswell, of the Lands Department of the New South Wales Government, as his partner. As the development of the Broken Hill mines was then in its early stages, he had no great difficulty in securing contracts with nearly all the Broken Hill companies on the Main Lode for the engineering work necessitated by their railway connections, the survey of their underground workings, and the preparation of plans and keeping them up to date. In 1891, owing to the extension of the open-cut system of mining by the Broken Hill Proprietary Co., Mr. Horwood was offered and accepted a position with that company to take charge of this department as being responsible for the general work hitherto done for the company. All together 4,500,000 cu.yd. was excavated, yielding 1,500,000 tons of ore. He received the appointment of mine manager in 1896, when the supervision of underground mining as well as of open-cut mining was given him. In 1899, he was appointed manager of the Broken Hill works, embracing all the company's operations at Broken Hill—a deserved promotion. About this time, owing to the duplication of the concentration mills operated by the company, the output of ore from underground was increased to 12,000 to 13,000 tons weekly. Mr. Horwood was granted six months' leave of absence in 1900 to enable him to visit the principal mining and metallurgical centers in Europe and the United States. Among his technical achievements has been an important contribution to metallurgical art. Having been closely associated with the development of the flotation method of ore treatment, in 1908 he discovered and patented the process which bears his name and which was the pioneer process of selective flotation treatment of concentrates of zinc-lead-sulphide slimes. By means of this process, after a preliminary light roast the lead sulphide is slightly oxidized or "deadened" and becomes unfloatable, while the zinc sulphide is not appreciably effected and is floated as high-grade zinc concentrate, leaving the lead as a residual concentrate. The process was installed and worked successfully at the Zinc Corporation Broken Hill for a year or two before the war, when the outlet for zinc concentrate was cut off. At the end of 1919, Mr. Horwood was transferred to the Melbourne office and appointed superintendent of mines, his present position, in which capacity he exercises general supervision over the quarrying and shipment of the iron ore from Iron Knob, in South Australia, and limestone from Devonport, Tasmania, to the Newcastle Steel Works, as well as over the operations at Broken Hill. During his thirty-two years' residence at Broken Hill Mr. Horwood had many exciting experiences, including those connected with several extensive underground fires and three general strikes of the employees, the last of which was seriously prolonged.

Mr. Horwood is a member of many years' standing of the American Institute of Mining and Metallurgical Engineers, the Institution of Mining and Metallurgy, in London, and the Australian Institute of Mining Engineers.

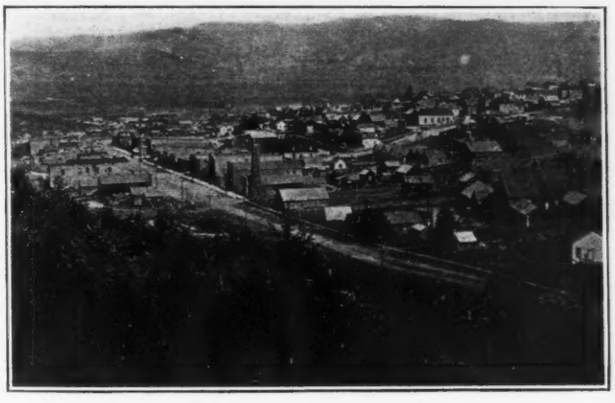
Milling Manganese Ore at Algonquin Mine, Philipsburg, Montana*

Improved Method of Hauling Now in Use—Tabling Superseded by Magnetic Separation in New Ore-dressing Plant

By Richard V. Ageton
Metal Mining Engineer, U. S. Bureau of Mines

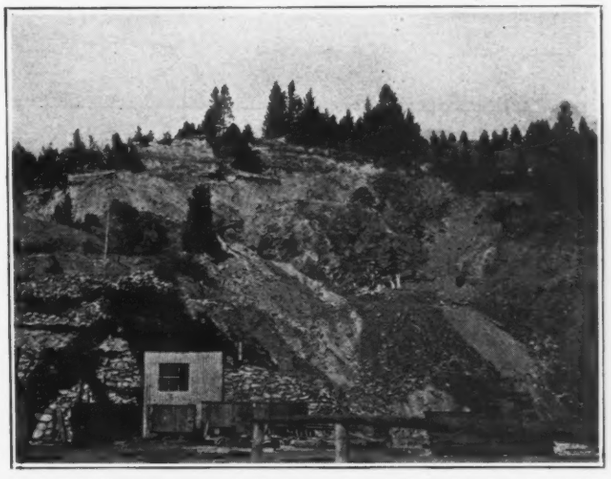
DURING 1917 AND 1918, the Philipsburg mining district of Montana supplied about half of the manganese ore used in the United States. The district was discovered in 1865, and until 1890 it ranked as the most productive silver field in the country. The decline in the value of silver in 1890 caused an abandonment of mining operations, which lasted until 1914, the beginning of the World War. Until 1916, Philipsburg had not been thought of as a source of manganese, though many of the mines, notably the Algonquin, have since produced large quantities of this ore, but this mine was the only one producing this mineral in September, 1922.

Philipsburg is situated in Granite County, in the southwestern part of Montana, about 100 miles northwest of Butte. The lodes of the district, of which the manganese deposits are an integral part, are regarded by Pardee[1] as being due to emanations from a deep-seated intrusive body which is probably a part of the Philipsburg granodiorite batholith. The orebodies are irregular in detail, but their general forms somewhat resemble cylinders, pipes, or pods. The manganese ores at the Algonquin mine consist of pyrolusite and psilomelane, which in all probability are oxidation products of the original rhodochrosite that accompanied the emanations from the main granodiorite batholith.



Bird's-eye view of Philipsburg, Mont.

The Algonquin mine is on the north bank of Frost Creek, about one and one-half miles from Philipsburg, and, like most of the other silver mines of the district, was idle for the period from 1892 to 1916. However, the body of manganese ore exposed along the old road from Philipsburg remained in view, and this was, therefore, one of the first of such deposits in the district to be worked during the war. Later development by the Philipsburg Mining Co. at the Algonquin shaft developed a small quantity of high-grade and a considerable quantity of low-grade ore.



Open cut of Algonquin, worked during the World War

The oxidized ores—pyrolusite and psilomelane—occur from the surface to and including the 500 level. This level is 450 ft. below present water level, and as 400 gal. of water per minute is coming out on the 500 level alone, the occurrence of oxidized ores below the present water level is of interest.

Transportation of Ore by Tractors

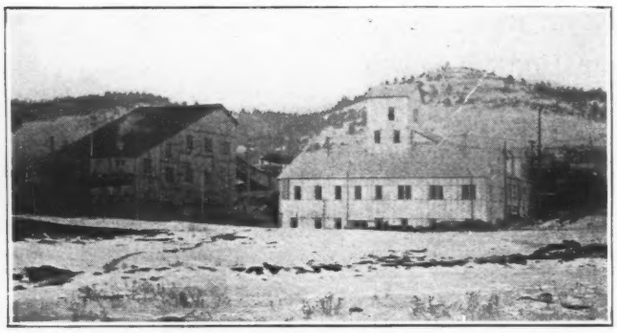
One of the most interesting features of the Philipsburg Mining Co.'s operations is the use of Holt caterpillar tractors and six-ton Troy ore wagons to haul

New method of hauling with a caterpillar tractor

*Published by permission of the Director, Bureau of Mines, Department of the Interior.

[1]Pardee, J. T., "Deposits of Manganese Ore in Montana," U. S. Geol. Surv. Bull. 725-C, 1921, pp. 156 and 159.

ore from the mine to the mill. Formerly, local carriers hauled all the ore with the usual six- and eight-horse teams and ore wagon and trailer, but such a team at best could make only two trips a day, or a maximum of



Old Algonquin mill at left; new mill at right

10 to 12 tons. With the tractors, from 85 to 90 tons per day are hauled, making only three trips. On this work they use three 75-hp. Holt caterpillar tractors, two of these hauling the ore, each trip consisting of five of the six-ton cars, or 30 tons per trip. The third tractor is used on road repairs, and is a stand-by in case of a breakdown on one of the ore-hauling tractors, and it is used, as well, for hauling timber and supplies to the mine.

A New Mill Erected

The first mill operated by the Philipsburg Mining Co. consisted of the usual jaw-crusher, rolls, jigs, and Wilfley table. However, it was found that on account of the friable character of the ore a fairly large quantity of the manganese was lost in the fines, and consequently some other method of dressing had to be adopted. With this end in view, and after much experimentation, the new mill was erected, a flow sheet of which is given herewith.

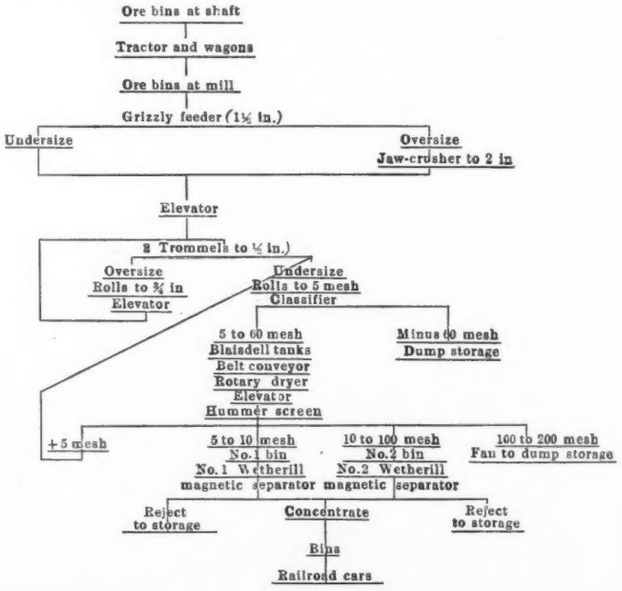
The ore is dumped from the wagons into five bins, at the top of the mill, each of which holds 35 tons, with bottom having a slope of 45 deg. The ore then passes down to a Ross grizzly feeder, in which the bars are spaced 1½ in. apart, the undersize going direct to

Side view of the No. 1 Wetherill Magnetic Separator

an elevator and the oversize to a 9x15-in. Blake crusher, which reduces all particles to smaller than 2 in. The crusher product goes to the elevator, from which it feeds into two Allis-Chalmers trommels, each 6 ft. long and 42 in. in diameter, having ½-in. round apertures. The oversize from these trommels goes to rolls set ¾ in. apart, and thence into another elevator and back to the trommels, completing a closed circuit. The undersize from the trommels is crushed to minus 5 mesh by another set of rolls, and then goes to a Dorr classifier, where two products are made—a coarse product of 5 to 60 mesh and a fine product of minus 60 mesh. The minus 60 mesh is sent direct to a storage dump, and may be re-treated later if desired.

The 5 to 60 mesh goes to two Blaisdell tanks, and remains therein for twelve hours. Each tank is 14 ft. in diameter and 10 ft. high, and holds approximately 76 tons of dry ore. In these tanks the moisture content of the ore is reduced from about 25 to 12 per cent. While one tank is being emptied the other is being filled, the discharge of each tank leading to a belt conveyor at 23 deg., and thence to the Buttner type drier.

This drier consists of a cylinder 23 ft. long by 59 in. in diameter, and the ore remains therein for a half-hour from the time it is fed in until discharged. All



Flow sheet of the new Algonquin mill

of the moisture is eliminated, and the dry ore is taken by a Jeffrey elevator to a Hum-mer screen at the top of the mill.

Magnetic Separation by Wetherill Machines

The 5- to 10-mesh product from the Hum-mer screen No. 1 bin is fed to a No. 1 Wetherill type E-3, six-pole, magnetic separator. The first two poles of this machine have 30,000, the second two poles have 60,000, and the last two poles 100,000 ampere turns. The product from pole No. 1 of No. 1 separator contains 10 per cent of iron, and is rejected; the products from poles Nos. 2, 3, 4, 5, and 6 contain 75 to 80 per cent of manganese. This product is taken to a bin on the lower floor, and is there sacked and shipped. The rejects from the machine fall from the end of the belt, and are taken by water to the tailing pond. The main belt—that is, the belt carrying the ore from the feed to the rejects—has a sped of 95 ft. per minute; the take-off belts from the different poles run at 250 ft. per minute.

The 10- to 100-mesh product from the Hum-mer screen, which is placed in No. 2 ore bin, is treated on a

No. 2 Wetherill separator, which is wound similarly to the No. 1 machine, and makes similar products, with the exception that the product from No. 1 pole contains 20 per cent of iron. The rejects from the end of both of these machines contain only 10 per cent of manganese dioxide and 70 per cent of silica.

The present ratio of concentration is 2 to 1.

Some of the concentrates—namely, the fines of the No. 2 separator—are sacked before being placed in railroad cars; the others are shipped in bulk. The concentrates (72 to 80 per cent MnO_2) are shipped to a firm at Cleveland, Ohio, and are used for making dry batteries.

The Importance of New Jersey Iron Ores

Improved Methods of Concentration Make Low-Grade Deposits of Magnesite Attractive

By H. M. Roche

THE high-grade iron ores so far almost exclusively used in the United States have been practically mined out, and the problem in the immediate future will be the development and mining of low-grade iron ores, followed by concentration. This applies not only to the Lake Superior region but to the New Jersey, New York, Pennsylvania, and Alabama ore deposits. The situation at present is somewhat as was the condition in the western copper fields at the time development of low-grade porphyry copper ores was started. The development of low-grade porphyry ores to successful enterprises took considerable time and money, and this condition will be found to apply also to the developing, mining, and concentrating of low-grade iron ores. The states of New Jersey, New York, and Pennsylvania are well advanced in the development of low-grade ores and have worked out the problems of beneficiating these ores successfully, whereas considerable experimental work will have to be carried on in the other regions before they can produce high-grade concentrated iron ores on a large scale.

In 1920, a total of 67,604,465 tons of iron ores was mined in the United States, of which about 2 per cent was mined in New York and New Jersey. The ore produced in 1920 by New York and New Jersey was magnetite. However, these two states, in addition to their large reserves of magnetite, contain a considerable tonnage of red hematite ores like those of the Birmingham district, and scattered deposits of brown ores in limestone. The Lake ores are decreasing in iron content, and as the freight rate on these ores is two and three-quarter times that of New Jersey ores to eastern furnaces, it is certain that eastern ores will command serious attention and will become much more important in the immediate future. Estimates of eastern iron ore reserves are not available, but magnetite ore reserves in New Jersey are probably at least 300,000,000 tons. Improved methods in concentrating magnetic iron ores have increased the tonnage of commercial ore in New Jersey several hundred per cent.

The consumption of iron ores in the eastern United States in normal times has been estimated at from 10,000,000 to 12,000,000 tons annually, and New Jersey could easily have produced 50 per cent of this tonnage. The railroad haul on such tonnage would not exceed 200 miles, whereas Lake ores are transported over 1,000 miles and foreign ores a considerably longer distance.

The orebodies in New Jersey are extremely persistent. There is no pinching, but strike faults cause slight displacements. The different oreshoots vary considerably in width, height, and shape, and along their strike persist for unknown distances; in fact, there is no known case where an oreshoot has been found to die out or become smaller in the direction along its strike. The downward course of oreshoots is sometimes interrupted by cross faults, but the faults are all later than the ore deposits and cannot permanently terminate them. In all cases where an adequate amount of development work has been done in search of faulted oreshoots, the continuations have been found.

According to E. C. Eckel, in his book on "Iron Ores," published in 1914, the Lake Superior iron-ore reserves were estimated to be 2,500,000,000 tons, and in the northeastern district, composed mostly of New Jersey, New York, and Pennsylvania, ore tonnage is estimated at 600,000,000 tons, which amount is equal to one-quarter of the Lake Superior ore reserves. It is my opinion that at least 1,500,000,000 tons of iron ore is available in New Jersey, New York, and Pennsylvania, or about one-half the present-day ore reserves of the Lake Superior region. Norton and LeFevre, (Vol. LVI, *Trans.* A.I.M.E.), state that there are 366 magnetite mines in New Jersey which could easily produce an average of 1,000,000 tons each, and that probably double this number of mines are listed but not yet opened. I believe that 32 per cent iron magnetic ore in the eastern United States may be considered at present as commercial ore which can be converted to high-grade ore by simple concentration processes, sintered partly or as a whole, and delivered to eastern furnaces at a cost under that of producing and delivering the natural Lake Superior ores to the same furnaces.

Certain magnetites, such as the Beach Glen concentrate, are soft and porous and require little more time for reduction than hematite, whereas some magnetites are so hard and dense as to require considerable more time for reduction. Any good revolving top mechanism will fill either magnetite or hematite satisfactorily. Sintering of fine iron ores cannot be done at present for less than $1.25 to $1.50 at modern plants, where flue dust is available for mixture with the ore and where either furnace or coke-oven gas is available to ignite the charge. Eastern magnetic concentrate as produced today at Beach Glen, Richard, Mount Hope, and Ringwood mines is much better prepared than formerly, and is excellent for use in furnaces without necessity of sintering.

At present the following mines are in operation in New Jersey:

1 at Ringwood, Passaic County—Non-bessemer ore.
1 at Oxford Furnace, Warren County—Non-bessemer ore.
1 at Beach Glen, Morris County—Bessemer ore.
1 at Mount Hope, Morris County—Non-bessemer ore.
1 at Richard Mine, Morris County—Non-bessemer ore.
1 at Replogle Mine, Morris County—Bessemer ore.

There are several advantages to furnaces in buying ores from New Jersey mines. First, there is generally a short one-line haul from the mines direct to eastern furnaces. Second, all classes of iron ore, such as non-bessemer, bessemer, and low-phosphorus ores, are found in New Jersey. Third, the mines have all-year operation and make daily deliveries of ore to furnaces, so that furnaces using Jersey ores are not required to stock ores in any quantity.

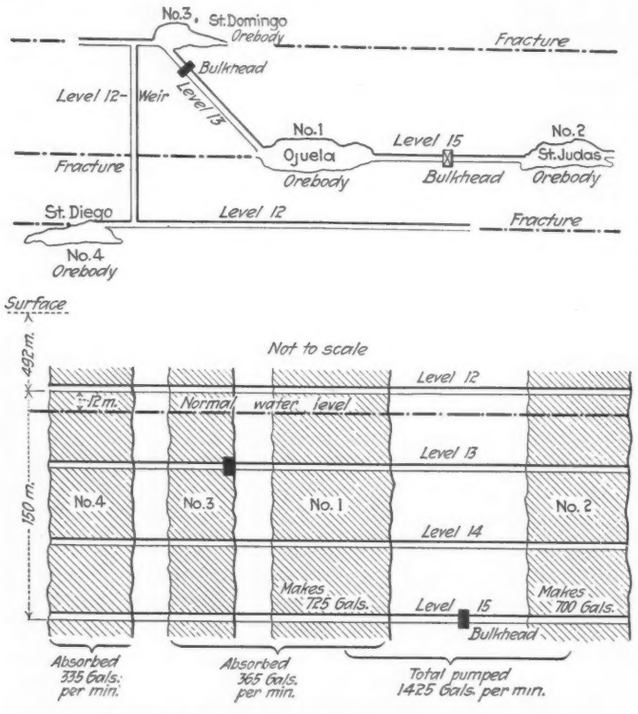
Economical Mine Pumping

Peculiar Condition of Fracturing Permits Unwatering of Workings at Low Cost

BY P. K. LUCKE
Consulting Mining Engineer

DURING the operation of the mines of the Cia. Minera de Peñoles, which are situated at Mapimi, in Durango, Mexico, at an altitude of 6,000 ft. above sea level, 2,000 gal. of water per minute was frequently pumped to the surface. The lift was 492 meters to the surface, and the cost per month varied as the depth and location of the workings, but was usually about 20,000 pesos, say $10,000. The workings dewatered were from 50 to 150 meters below permanent water level, during the period that is under consideration in this article.

The mines are in Cretaceous limestone, which has been lifted and contorted by igneous agencies. These



Plan and section of workings, showing position of bulkheads

movements and contractions have caused extensive fracturing, and in this case there are seven fractures of economic importance, as the orebodies occur at or near them. These fractures are at varying distances from one another, some being 50 meters apart and others 100 meters, and they can be traced for over a mile running practically parallel to one another, until they are lost sight of in the wash at the foot of the mountains. The igneous rock which caused the fractures was discovered by diamond drill to lie at a depth of about 2,000 meters beneath the surface. Fractures in this soluble limestone allowed the ascension of mineralized solutions, and great caves filled with ore were formed, which have been worked profitably to depths of 980 meters and, in some cases, reach cross-sections of 4,000 square meters.

During the period considered, No. 1 orebody, indicated in the accompanying sketch, was being worked to level 15, and was producing 725 gal. of water per minute. No. 2 orebody, on the same fracture, was responsible for another 700 gal. of water per minute. All pumping from both orebodies took place at No. 1, as they were connected by a drive with each other at level 15.

When No. 1 orebody was finally worked out, it was decided to put in a concrete bulkhead between No. 1 and No. 2 orebodies, remove the pumps from No. 1 orebody, and install those necessary at No. 2, on level 15, which was then producing 700 gal. per minute. This change made it unnecessary to pump the 725 gal. being made by No. 1 orebody.

As the worked-out No. 1 orebody and subsidiary drifts now represented a hole capable of holding about 45,000,000 gal. of water, it was decided to pump all the No. 2 orebody water through the bulkhead into this hole. This was done, and it took forty-five days to fill the excavation to level 12, thus saving that amount of pumping to the surface.

From No. 1 orebody at level 13 the water was allowed to flow through another bulkhead to the workings in No. 3 orebody, on another fracture, to take advantage of the excavation of that worked-out orebody. When this was filled, the water rose to level 12, and along a ditch in the crosscut from No. 3 to No. 4 orebody at level 12. No. 3 and 4 orebodies are on separate fractures, as indicated in the sketch. A weir was placed in this crosscut to determine the amount of water which flowed toward No. 4 orebody. This was found to be only 335 gal. per minute.

Thus was proved that the various fractures, of which we had been making use, were carrying water away. The balance was then dropped down into the abandoned workings of No. 4 orebody, and we were delighted to observe that no further water reached level 12. In other words, no more water had to be pumped to the surface, as we were disposing of it underground. The normal water level was raised in the various fractures, which, of course, in this case were not connected with one another by workings or cross-fractures.

The cost of pumping prior to the change was about 20,000 pesos per month. Afterward it was about 8,000 pesos. Thus the company saved about 144,000 pesos per year. The idea, however, can only be applied to mines in which extensive fracturing occurs and in which these fractures are not at all connected with each other by cross-fractures. Though such cases are undoubtedly rare, it is hoped that others may profit by our experience.

Fossils in Queensland

In shafts sunk in prospecting on the Darling Downs in Queensland, Australia, some particularly interesting fossil remains have been found. These include representatives of at least three kinds of extinct marsupials. Some of the fossils are too fragmentary to be of value, but a collection made for the Queensland Museum embraces the following: Nearly complete calcaneum, or heel-bone of diprotodon australis owen, a gigantic marsupial which was larger than a bullock, and which in some respects resembles a wombat; the fragment of a molar tooth of notothreim, another gigantic marsupial belonging to the diprotodon group. Portion of the left pelvic girdle of a large extinct kangaroo, probably marcopus anak, showing acepabulum or basin-like cavity for the head of the femur or thighbone.

Gold Mining in Eastern Siberia

A Résumé of Past Operations in a Vast Territory That Has Produced Much Gold—Evidently the Region Is Worth Prospecting—Climate—Labor—Transportation—Political Conditions

By F. L. Cole
Harbin, Manchuria, China

F. L. Cole

THE potential gold resources of the mining regions embracing a portion of the southern part of Yakutsk Province, all of Amur Province and the Maritime or Primorsk Province north of the Amur River to the 56th parallel, as shown on the accompanying map of southeastern Siberia, are great. Some of the descriptions here set forth are meager and some may be not entirely accurate; but the facts remain that gold was produced and profits were made when operations were in progress, and it is reasonable to suppose that in the large area which has only been partly prospected there exist similar or better opportunities. Under the former Russian Government much information was available from the various government mining offices. Most of the records of these offices have been destroyed or misplaced, and Messrs. Zeitseff and Hlebnikoff, of the Far Eastern Bureau of Mines, have been patiently accumulating information from various sources, some of which I have tried to assemble for publication.

Crude Methods Have Always Been Used

With few exceptions, gold placer mining enterprises in Siberia were all of the pick-and-shovel type of mining. Transportation was expensive and difficult, labor was plentiful, particularly where Chinese and Koreans were employed, and it was easy to lease the ground for a percentage of the output, or a fee based on the number of laborers employed. Supplies could be sold at a good profit. With the systems employed there was little attempt toward refinement of methods, and only ground which was rich was touched. It is safe to estimate that the actual production was one-third more than was officially reported. In many instances the methods used were rough and crude, and there may be many places where more modern methods could be applied to advantage.

At present practically no work is being done except by wandering miners who work where they please. Very little farming is being done in the agricultural areas, because of lack of work animals and because the farmers are afraid of their crops being requisitioned by the government. Provisions and tools for mining are scarce.

The former transportation systems are in bad condition, and though the Chita Government has given notice that it will guarantee protection for exploiters, it is doubtful at present if that protection would be sufficient to induce work to be started on a large scale on any property far removed from Chita. However, general political conditions are becoming better. Starvation may drive the people to work, and there are good opportunities to make agreements with the local government on reasonable terms and with a long period for exploration.

Climate No Bar to Exploitation

There are no physical or climatical reasons why many mining operations could not be carried on all the year round in many places, provided a careful study is made of local conditions and the methods and plant employed are selected with due regard to local labor and other operating factors.

Numerous gold-bearing lodes have been found, but little attention has been paid to these. Hundreds of tributary streams have been prospected and found to contain gold.

A few foreigners have recently concluded agreements with the Chita Government for working several areas, and a small dredge on a branch of the Selemdja River, in the Zeya district, is being made ready for work. It is quite remarkable that Japanese have not as yet paid much attention to gold mining in Siberia. The terms offered by the government have been in the form of a lease for thirty-six years, with privilege of renewal and with royalties and taxes to the amount of from 5 to 12 per cent of the output. There are several objectionable features regarding government supervision and labor control in the recent regulations, but, like many things Oriental, these are counted as being more "face savers" than actual realities.

In several areas where leases have been granted to foreigners it has been found that the properties are being worked by local people, who refuse to leave, and consequently arrangements have to be made with these people or exploration and development abandoned until the holders can be driven off.

As industry of all kinds is stagnant in the Eastern Provinces, and mining and agriculture are the only sources of production, it is reasonable to suppose that the policy of requisitioning crops and offering obstruction to mining development eventually will be removed.

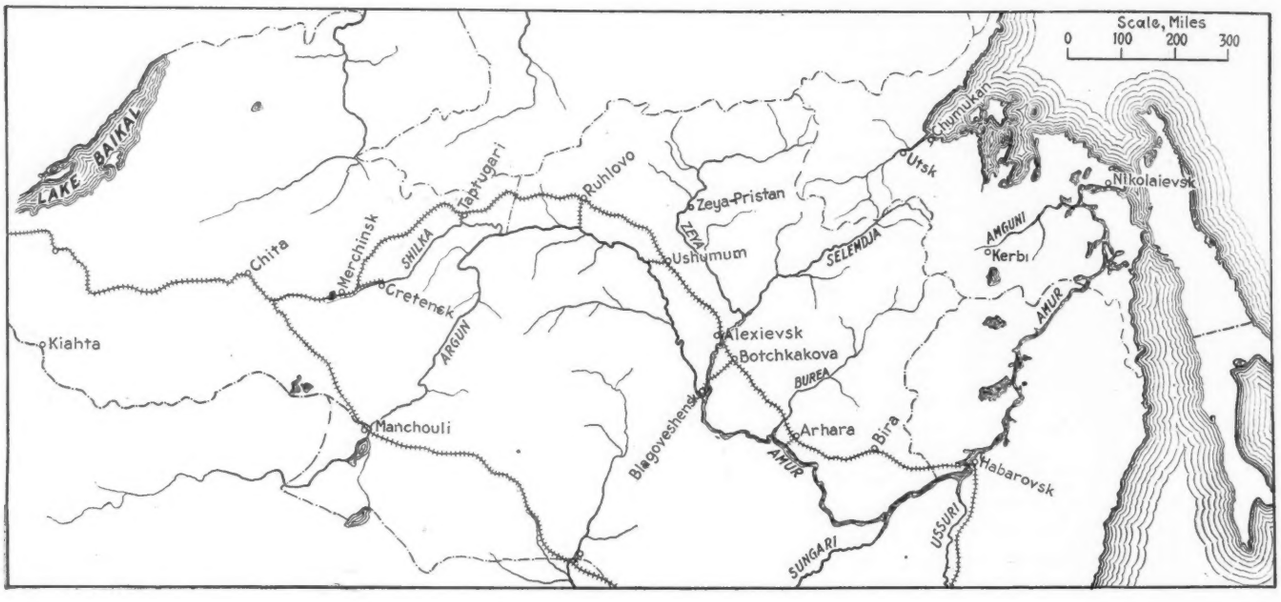
The inhabitants are gradually beginning to see the fallacies of bolshevism, and starvation is becoming more general, and the fact that they will have to pull themselves out of the situation in which they are involved must eventually be realized by even the most radical.

It is too much to expect from a people who for generations have had individual energy stifled, whose mode of life has been laid out for them, and who have done only what they were told to do, that they will evolve any sort of a government except along the old lines of

numerous officials and interminable documents, but progress is being made toward taking steps that may attract foreign capital.

Most of the former mine operators are refugees. Their titles are being recognized by the local government, and a few former owners are allowed to return. As the former titles were only leases from the government, and possession depended on operation and payment of taxes, the same system has been adopted by the present government, except that the term of the leases is fixed.

There are numerous valleys and river systems which of course are not shown on the accompanying map. The country is not mountainous; the stream sources are



Map of southeastern Siberia

on the marshy divides, which are usually flat, and with few exceptions flow through wide marshy valleys with gently sloping sides, but with sufficient fall to produce swift currents.

The surface is covered with timber, and north of the Amur in many places is tundra. The winters are cold and dry, with little snow except along the coast, and the summers are warm and moist. According to records 70 to 80 per cent of rain falls in the month of July, and floods are frequent during this month. In many localities the ground is perpetually frozen, particularly in the tundra and swampy areas; it thaws in the summer to a depth of a few feet.

Freighting Done in Winter

Transportation is good in some parts of the area where navigable rivers can be utilized in the summer. There are practically no roads, and the few that were made prior to the revolution are badly in need of repair. Except where the rivers are navigable or adjacent to the North Amur railway, most of the travel and hauling has to be done in winter on sleighs along the frozen streams and across country.

The gold-bearing area is composed of older crystalline rocks, such as granites and gneisses, together with metamorphic slates, sandstones, and similar rocks. Along the contacts between these two systems are found the placers. Gold-bearing quartz veins occur at or near the contacts. Gold placers have been found in the present stream channels, in older channels in the present valleys, and in old channels above and along the sides of the present streams. The depth of the gravel is usually shallow, from 10 to 20 ft.

In the last few years the Russian miners calculated that except in favorable localities for transportation, values of from $1 to $1.50 (gold) per cubic yard must be obtained for the ground to be worked profitably by hand methods. It is quite probable that Chinese and Koreans worked ground containing less.

In former times the government mining department divided gold placer mining into seven classes:

1. Operation of dredges and mechanical excavators. The yearly output in the area under consideration was 15,000 to 21,000 oz.

2. Operation by proprietors who hired labor to work under their direction. The gravel was washed in short sluices and rockers, and the yearly output was 53,000 to 63,000 oz.

3. Operation similar to (2), except that the proprietor bought the gold from the workmen at a fixed price below the market price and the gold production was strictly supervised. Yearly output was about 63,000 oz.

4. Leasing operations under a system whereby a number of workmen would lease a property and develop it independently, the proprietor receiving a fixed fee per day per man employed or a fixed proportion of the output.

5. Operations in which Chinese and Korean laborers were employed, who guaranteed the proprietor a fixed output per man employed, the work to be done in any manner the workmen wished. Any surplus output over the fixed rate was sold to the proprietor.

6. Operations similar to (5), except that the proprietor kept a storehouse on the property and the workmen were required to buy a certain amount of supplies and the proprietor paid a fixed price for the output.

7. Stealing of gold by the workmen in engaged in (1), (2) and (3).

The first class produced the least gold, as there were few dredges and mechanical appliances. The fourth, fifth and sixth classes produced the largest amount of gold, and as opportunities for smuggling part of the output into China were plentiful, it is doubtful if the official records, if available, would give the true output. In all cases the tendency to make the output smaller in order to lessen the amount of taxes and royalties was prevalent.

Operations Were Extensive

Placer mining began in 1862, and up to 1880 was in the hands of Russian capitalists, who worked only a few rich places. After 1880 individual prospectors and small operators were allowed to work, and after 1887 they were permitted to employ Chinese and Koreans.

The earlier miners worked only ground that averaged not less than $8.50 per cubic yard; and after 1880 ground that averaged from $2.50 to $4 per cubic yard could be worked. The annual average number of men employed since 1887 was 25,000, of whom 16 per cent were Russian, 70 per cent Chinese, and 14 per cent Korean.

In 1915 there were filed 5,742 gold claims in the Habarovsk Government mining office, which was the central office for the area being considered, as well as all of the Maritime Province, Chukotsk Peninsula, Kamchatka, and Saghalin Island. In the same year 1,353 were proved and surveyed. Of these 90 per cent were in Amur Province. Productive work was actually in progress on 441 gold claims, and of that number 397 were worked by Chinese and Koreans and 44 by Russians. Of the latter, 33 were hand operations, 7 had dredges, 2 hydraulic giants, and 2 had mechanical excavators.

In 1917 the total amount of gold reported as produced by the various mining offices in the above districts was 514,546 oz., of which 98.2 per cent was from placers.

Zeya Mining District

The government mining office for the Zeya district was situated in the town of Zeya-Pristan, which contained 8,000 inhabitants in 1914. The town is on the Zeya River, 433 miles by river from its mouth at Blagoveschensk. The Zeya River is navigable to this point and 80 miles further for steamers drawing 7 ft. and for a further 58 miles for steamers drawing 3 ft. Adjacent to this town is a rich agricultural district. In the few years previous to 1914 the average yearly tonnage of freight imported to Zeya-Pristan was 15,500, which was carried in steamers and barges. In winter an average of 750 tons was imported by sleighs, making a total import of 16,250 tons yearly. In the same period the average gold output of this district was from 183,665 oz. to 198,000 oz.; an average of 63,000 oz. was produced by the Upper Amur Gold Mining Co.

It was customary to count thirty to forty-five tons of import cargo to an output of 527 oz. of gold. Gold was the medium of exchange for imports. The area of the whole Zeya district, with the addition of part of the lower Yakutsk district, equals 110,600 square miles, the Zeya alone being 96,000 square miles. The recorded gold-mining properties in these districts had an area of 8,453 square miles.

The first placers in the Zeya region were discovered in 1874 in the tributaries of the Upper Zeya, and the Zeya district is the oldest in the Amur region. Except the Upper Amur Gold Mining Co., which had a few hydraulic giants operating, and a 5-ft. New Zealand type dredge on the Unaha River, owned by a Russian named Aksentieff, all the mining was done by hand methods. Some high-grade gold lode deposits were discovered in recent years, but no systematical work was done.

The few roads in the district are not more than tracks, and supplies were usually transported in summer by steamer to the farthest navigable point and stored until snowfall, when they were hauled to the mines on sledges. The cost of freight to remote places was as high as $2 to $2.50 per pood (36 lb.).

With sleigh transport it was reckoned that a camel would pull about half a ton, and for a 217-mile haul and return required 220 lb. of feed; a horse would pull a little less than a camel, but required 550 lb. of feed; and a reindeer would pull one-third of a ton and needed no feed. Reindeer and camel would average 20 miles per day and horses 14 miles.

The Aldansk district is situated in Yakutsk Province on the headwaters of the Aldan River and its tributaries Uguri, Gonoman, and Timpton. The Aldan is a tributary of the Lena. The principal workings were those of the Upper Amur company and Oparin, which are about 217 miles equally distant from Station Ruhlovo, on the Northern Amur railway, and Zeya-Pristan. The properties were worked by hand methods and the gold content was high. The gravel was 5 to 20 ft. deep, and mostly frozen, with no large boulders.

The Timpton district adjoins the Aldan on the west. There are spots where the ground is not perpetually frozen. The records show that one "artel" of eight men, with a home-made hand dredge, obtained $8 to $11 per man per day by working in the channel of the Timpton River. They worked in narrow cuts along the stream. The Upper Amur company operated here in a small way, with good results.

The Sudgdjar Tok district is in the upper part of the Zeya River, in the streams Zeya, Sudja, and Arga, with its center at Bomnal, on that river, 58 miles from Zeya-Pristan. The ground is perpetually frozen, but the gravel is rich. Hand work only has been done, but with good results. Freight on the river to Bomnal costs 75c. to $1 per pood from Zeya-Pristan, and 25c. per pood from Bomnal to the mines.

Unia-Bom district is on the Unia River, which flows into the Arga and the upper part of the Nora River, which flows into the Selemdja. This is a recently discovered region, and the ground worked proved to be rich. Communication is by river during winter only. The distance of the center of the region from Bomnal is 175 miles, and it is the same distance from Norsk warehouse on the Selemdja.

The Zeya Central district comprises the rivers Zeya, Patchinsky, Dambuki, Inaragda, Vladimirski, and Brianta. There were several roads in this district, and freight costs from 25c. to $1 per pood from river port to mines. A light New Zealand type Holland-built dredge, with 5-cu.ft. buckets, was operated on the Unaha River for five years, and eventually some profit was made. Many difficulties were encountered from the swift current, boulders, and hard bedrock; the dredge had to be completely altered before it could operate successfully. This dredge averaged from 760 to 800 yd. per day for 110 to 120 days per year. The depth of the river at low water is 4 ft. and average water is 7 ft. The dredge dug 10 ft. of gravel in a

cut 210 ft. wide. The gravel averaged 25c. per yard of recovered gold.

The Upper Amur Gold Mining Co., near Zeisk, on the Somnitelny mine, dug a 10-mile ditch and a long pipe line for hydraulic operation, but could not obtain enough water to work on a large scale. There were many hand placer operations in this district, and numerous gold-bearing quartz veins have also been discovered. The Gilui River is interesting as being the large right tributary of the Zeya, and the gold is known to occur in its bed along practically its whole length. Conditions unfavorable to dredging are large boulders and quick, high floods.

The Nogotok district is in the upper part of the Gilui River, adjoining Timpton. There are no roads, but considerable placer mining work has been done, with good results.

In 1878 placer mining was started on Toltzevo Creek, a tributary of the Hugdera which enters the Gilui from the right about 70 miles from its mouth. Up to 1917 this property is reported to have produced $6,000,000 worth of gold. In 1917 a careful examination was made of the vicinity, and a rich gold-bearing quartz vein was discovered, and the locality is now known as "The Mountain of Gold." Government reports show that the vein occurs in gneiss and parallels a "berisite" dike about 50 ft. distant, and averages from 2 to 4 ft. wide. From the surface to 85 ft. the vein is composed of quartz, hematite, and anorthite. Below 85 ft. are undecomposed iron pyrites, which appear to increase with depth.

The gold is coarse and is found free in the hematite and anorthite. In the quartz the content is not more than $4 per ton. Tests of the hematite and anorthite show from $33 to $1,000 per ton.

Free gold was noticed in the gneiss footwall. The gold was from 934 to 987 fine. Little work has been done on this vein, but the surrounding surface and the drainage area below have yielded rich returns.

The bed of Toltzevo Creek has been worked out, and crystals of gold are reported to have been found during mining operations. A bench channel was discovered which contained 2 to 6 ft. of "pay streak" averaging 200 ft. wide, under an overburden of 35 ft. The pay streak averaged $10 per yard, and the gold was 965 fine. The overburden is mostly frozen, and work was done by thawing and drifting. The bedrock is mica schist.

Burea Mining District

The Burea district contains the Upper Selemdja River, which enters the Zeya about 150 miles above its mouth, and the rivers Narga, Elga, Nieman-Burea and the upper part of the Burea from a point about 150 miles above its mouth.

Geological notes along the Selemdja River show that from the source down to the Bisi River the predominant rocks are gneisses, granites, syenites, and porphyries. In a small area just above the mouth of the Min River quartzites and crystalline schists are found.

Below the Bisi are found Jurassic formations, and nearer the mouth of the Selemdja are later Tertiary sedimentaries. A systematic study of the geology of the Selemdja was begun in 1912 by Messrs. Ivarovsky and Kleponin. Messrs. Gogolipsky and Ivanoff have described some of the placers along the Selemdja. Also, special commissions have reported on the Selemdja valley its suitability for colonization. There are numerous settlements in this valley. The total length of the river is 400 miles; it has a fall of 3,444 ft. From its mouth to Norsk warehouse, 75 miles, it is navigable for the large Zeya River steamers, and light-draft steamers have reached Ekimtchan, 130 miles above its mouth. There are many shifting sand bars, which make navigation difficult.

American-Made Machinery Formerly Extensively Used

The administrative center for this district was the city of Blagoveschensk, at the mouth of the Zeya, on the Amur River. This city was the largest in the Amur region, and it was the general distributing point for a large territory. At present it is a wreck; it is without a decent store; its inhabitants are only partially clothed and are hungry; its industries are dead. Incidentally, there were 30,000 American agricultural machines in the Blagoveschensk region in 1917 and 5,000 plows were sold in 1916 and 1917.

The Selemdja region alone annually required 11,800 tons of imports and returned gold to the value of $1,500,000. A road was partly constructed up the Selemdja valley across to the headwaters of the Amgun and down that valley to the settlement of Kerbi.

A total area of 81,000 acres of gold properties were recorded for the Burea district. Some typical mining enterprises in this district will be described. The first successful dredging operation in this district was undertaken by the Amur Gold Mining Co., the principal owner being P. V. Mordin, who recently died a penniless refugee in Vladivostok, on the Kharga River, a tributary of the Selemdja.

The first dredge had a 5-cu.ft. bucket capacity. It was of New Zealand type, built by Werf Conrad in Holland. The total weight of the dredge, including steel pontoon, was 508 long tons. The cost delivered at Blagoveschensk in 1913 was $55,000. This dredge was carried by river steamer to Norsk warehouse, on the Selemdja, and thence by sleighs to the Zlatoustovsk placers on the Kharga, about 245 miles. The cost of transport from Blagoveschensk was $35,000 and the total cost erected, with incidental expenses, was itemized as follows:

Cost delivered Blagoveschensk	$55,000
Transport to dredging ground	35,000
Erecting	10,500
Equipping machine shop	6,000
Erecting quarters and village	9,000
Total cost of dredge and buildings	$115,500

The erection was begun in January and was finished at the end of May, 1914. Actual dredging was started in June and ceased on Oct. 15. The depth of gravel averaged 12 ft., with no boulders which could not be handled by the dredge buckets, and the bedrock was schist.

The ground dredged was stream bed and bars on the sides of the stream. The gold occurs in grains from very fine up to the size of a pea. It amalgamates well and was easily saved on the dredge tables and in the sluices. The record of operations for the first season was as follows:

Days worked	104
Days lost on account of high water and breakages	27
Total working hours	2,498
Cubic yards handled	158,521
Daily average yardage	1,521
Average daily working time	19 hr. 49 min.
Average value recovered per cu.yd.	$0.7582
Value of gold recovered	$120,199
Operating costs, (13.56 c. per yard)	$21,502
Loss for the season over cost of dredge and operating costs	$16,803

This dredge operated until 1919 with similar results.

After the success of the first dredge the same company ordered two more of the same size, which were installed in 1915. Each dredge produced an average of $135,000 per season until operations were stopped by the radicals in 1919.

Three typical hand placer workings on small tributaries of the Selemdja are:

A. Work began in 1902 in a wide marshy valley, and during the first six years produced 6,840 oz. of gold. The gold occurred in fine and rounded grains, and the average content of the pay gravel was $2.50 per yard. The pay gravel was spotted and from 10 to 30 ft. wide. The overburden of slimy decomposed vegetation and clay was 3½ ft. deep and the pay gravel 4 to 6 ft. deep. This latter contained a certain amount of sticky clay, but was mostly fragments of fine-grained gray quartzite, lying in shingled layers, and reddish gray gneiss gravel. The gold occurred mostly on the rough bedrock, which was a reddish-gray fine-grained gneiss. The gravel was hand screened and washed in rockers.

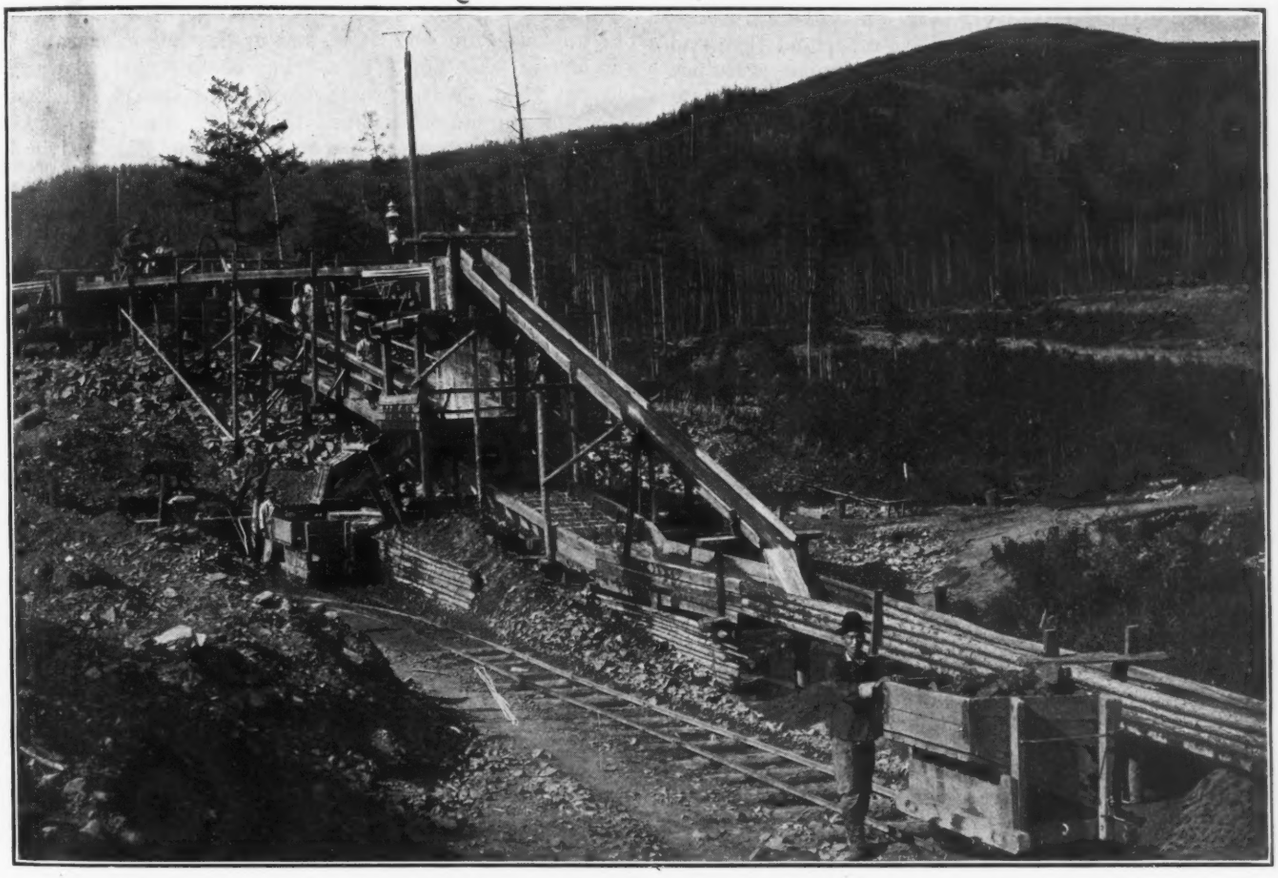
B. In another similar marshy valley. The overburden similar to *A* was 3 ft. deep and the pay streak was from 3 to 13 ft. deep. The pay gravel consisted principally of small quartz boulders, with clay and black sand. The gold occurred mostly near the bedrock with black sands. The bedrock was soft schist. The value of the pay gravel was $4 per yard, and the gold was coarse and spongy and mixed with quartz. Nuggets of the size of 1½ oz. were common.

C. In another marshy valley. The overburden was 10 ft. deep and the pay gravel 3½ ft. The latter was principally fragments of schists with a little quartz. The gold was fine and both rounded and flaky. The pay gravel averaged $2.50 per yard, and most of the gold was found near the gneiss bedrock. On this property was a large quartz outcrop, and on sinking a shaft a few feet deep an apparent true vein several inches wide was found in the gneiss. Numerous small quartz lenses were found near the vein. Some were as much as 5 in. in width. All the quartz carried free gold. No further development work was done.

In the Nieman-Burea district, on the upper part of the Burea River, near the sources of the Burea, Selemdja, Kerbi, and Amgun, are found deep gravels which have been profitably worked by hand methods. Communication was principally by sleigh in winter from Blagoveschensk, and the average yearly tonnage of supplies brought to this region was 9,000. The gold output averaged 42,122 oz. The depth of overburden was 50 to 60 ft. and the pay gravel averaged $3.60 per yard. The cost of freight in winter was $1.25 per pood and in summer $3.25. The output of the Burea district, including the Selemdja valley, varied between 126,379 and 157,988 oz. yearly. The government estimated costs for hand work on owner-worked properties as follows: Labor, 66 per cent; staff, 5 per cent; prospecting, 13 per cent; communications, 16 per cent.

It was estimated that Chinese leasers operated for the same items as above 64, 17, 5, and 14 per cent respectively.

The government taxes and royalties amounted to 12½ per cent of the total output, and the Burea district paid to the government an annual amount of about



Typical Siberian gold-washing plant

$100,000 from privately owned and operated claims. Besides this there was royalty and taxes to the amount of $90,000 annually from leased government-owned mining lands.

The average value of gold from the Burea district was $17.18 per oz.

Primorsk Mining District

Nikolaievsk, at the mouth of the Amur, is the center of the Primorsk district, and most of the operations have been on the rivers Kerbi and Amgun. Many of the claims have been worked twice. Most of the ground in this district is unfrozen and it offers advantages for dredging that other districts do not. Several large operations have been successfully carried on. The Amgun Gold Mining Co. had two dredges on its property on the Gongren River, near the town of Kerbi. One dredge was a Werf Conrad New Zealand type and one a Putiloff. It is reported that the dredges were not suitable for the ground. This region had an annual output of 10,500 to 15,000 oz. yearly. It consumed 5,000 tons of freight, and the gold-bearing area was 27,000 acres.

Transportation was by steamer from Nikolaevsk to Kerbi and from there by the road to the Selemdja, the first 80 miles of which was well made. This region is well worthy of attention, on account of its accessibility and unfrozen gravel.

Near the mouth of the Amgun is the Orsk property, formerly known as the "Kolchan." This has been described in detail in numerous articles. Unfortunately, the two dredges were burnt by "partizans" in 1918.

The Udil region is in the river systems which drain into Lake Udil and is reached from the station of Bogorodskoe, on the Amur. Two dredges were operating here and several large hand operations were doing well up to 1918. This is a new district and has a large amount of unprospected territory. Several gold-bearing quartz lodes have been found. The annual output from this region was 8,000 to 10,000 oz. The entire output of the Primorsk district averaged 32,000 oz. for the last few years of operations.

Amur Mining District

The Amur district is the oldest in Siberia, and its center was Blagoveschensk. It embraces nearly all the territory in the Amur and Primorsk provinces between the Northern Amur railway and the Amur River and includes the lower Zeya. The total area of gold-mining properties was formerly 40,500 acres, and the annual output 79,000 oz.

The interesting regions are Djalinda Urkan, Oldoi, Hingan, Bira, Mamin, and the lower 75 miles of the Selemdja. This district is favored with rail and water communications as well as numerous good roads. It is well settled and contains quite a large agricultural population. The Djalinda-Urkan district is the oldest of the region. In the center of this district are the Upper Amur Gold Mining Co.'s properties, which were connected with a good road, 30 miles long, from the railway station Ruhlovo. Ruhlovo is connected with Djalinda on the Amur by a good road 80 miles long. The gravels of the old workings were so rich that they have been worked over profitably several times. During the last few years of operation properties produced 17,000 to 21,000 oz. annually. Much ground has been well prospected and dredges were to have been installed when work was stopped in 1918.

Several favorable gold-quartz lodes were discovered and some little development was done on them. One of the properties in this district was working a channel covered with 3 ft. of soil and with pay gravel 6 ft. deep. Below this pay gravel a shaft was sunk through sand and small gravel for 56 ft. without finding bedrock. Tests ran as high as 75c. per yard.

The work was done in the form of an open cut 1,750 ft. long in which a steam excavator was operated to fill trucks, which were drawn to the washing plant by a small locomotive.

Recovery of Gold Not Good

The excavator consumed 294 cu.ft. of firewood per day and dug 2,000 yd. The washing plant was equipped with two revolving screens. There were no amalgamating plates and the tables were covered with matting. The gold was fine and flaky, and evidently considerable was lost in washing. The average value recovered was 75c. per yard. Water was brought six miles in sluices.

During the construction of the North Amur railway new rich diggings were discovered on the Oldoi River which averaged $2.50 to $3.75 per yard. Most of the ground is unfrozen, and conditions are favorable for dredging. Five thousand to six thousand ounces was produced annually.

The Hingan district, which has its center at the town of Ralde, has been but little prospected, but some mining has been done. The Hingan range is covered with good merchantable timber.

The Bira district is the drainage area of the Bira River, which flows into the Amur near Habarovsk. In 1915 rich gravel that ran as high as $25 per yard was discovered, but very little work has been done. The district is suitable for dredging.

The Mamin district is the drainage of the Mamin River, which flows into the lower Selemdja from the north. Fairly good values have been found along this river for a distance of 40 miles, and conditions favorable for dredging are reported.

The lower Selemdja River contains bars and river bed which are reported to contain $2.50 per cubic yard in fine gold; dredging conditions are good. Gold-bearing quartz veins have also been discovered.

It is reasonable to suppose that the above-described known gold-bearing areas, most of which are easily accessible, will play a considerable part in the future world gold supply. The uncertain fact at present is the length of time before a government which will assist exploitation will be in control of affairs. That such a government will be forthcoming is the earnest hope of all of us who have lived in the country and known something of its people.

Metal Mining in Nevada Healthy in 1923

The mines of Nevada showed a healthful increase in activity during the first six months of 1923, according to statistics compiled by V. C. Heikes, of the U. S. Geological Survey. The companies producing silver naturally tried to market as much bullion as possible while the price was $1 an ounce, and the copper mines and zinc mines made every effort to return to a normal output under the stimulus of increasing prices. In 1922 the value of the metal output was $15,705,609, as against $12,137,536 in 1921. The output of recent years has been small compared with that of 1917, when the mines of Nevada produced metals valued at $54,000,000.

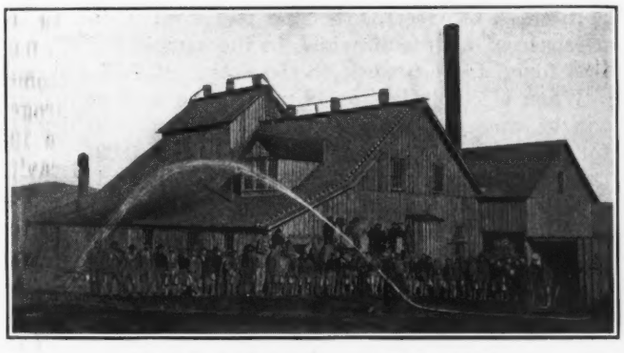
Tuscarora—An Old-time Camp

BY FRANK M. LELAND

DURING the 80's, Tuscarora was one of Nevada's leading producers. In 1916 I visited the old camp after an absence of thirty years and took a few snapshots. The ruins of the compressor and hoist of the Navajo mine are shown. The compressor was a No. 7 Burleigh, with poppet valves on the steam cylinder, and was then considered the highest type of air compressor, but as the air was cooled by injecting water directly into the air cylinders we always had our freezing troubles.

The picture of the Navajo hoisting plant was taken in 1884 from the same point. There were about 100 men employed at the mine above and below. The miners received $3.50 for ten hours and all engineers and mechanics $5. The engineers worked twelve hours. It was a rare thing for a man to quit or get fired. The men took an interest in their work and mostly saved money.

The miners of those days were vastly different from those of today. Many belonged to lodges and all took an interest in the town's affairs, and on the Fourth of July and St. Patrick's Day there was always a big turnout. The men took pride in being miners. The superintendent knew them all by their first names, and it was a common thing to see three or four miners



Navajo Independence mill in 1884

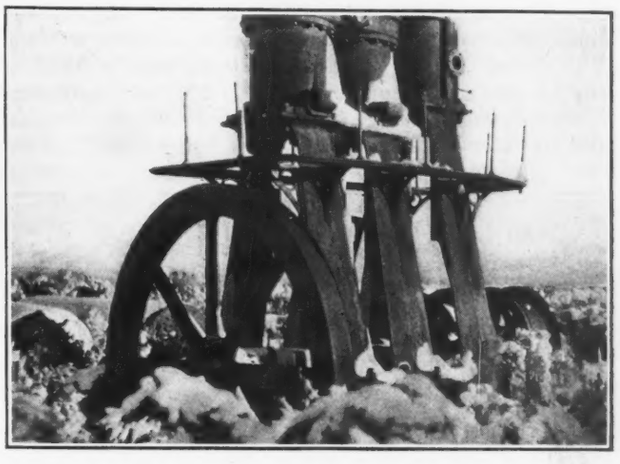
drop into the company office and sit around the stove and talk. I would like to see one of our modern operators get a crew like this together and run his mine on a 1 per cent labor turnover.

The Navajo Independence mill is in ruins. The engine was a 16x30-in. Myers cut-off, built by Prescott, Scott & Co., of San Francisco, afterward the Union Iron Works. This engine ran a 10-stamp dry crushing mill with Howell White roasters, pans, and settlers. We used to put through from ten to eleven tons in twenty-four hours, and our ore averaged over $400 per ton. In fact, we used to ship as high as $150,000 some months. From the Navajo mine alone we milled about $5,000,000. We used green sagebrush for fuel, and the ore was hauled from the mine bins by wagon after being carefully sacked. We had a crew of thirty-five men, and all worked twelve hours. The battery was fed by hand.

The shells of the boilers are all that is left of the Grand Prize hoisting plant. This was a wet mine, and it cost about $300 daily for green sagebrush, and we used to fire the boilers with a pitchfork. What money we could have saved with the mining machinery we have today!

Navajo hoisting plant in 1884

Now and then we read of some small town which has produced a celebrity, and it brings to my mind the many men now prominent in mining, oil, and financial circles who made their start in Tuscarora. I was talking with one of them not long ago, and I asked him how he accounted for it. His answer was that only the toughest of them lived, and when they had gotten by a few years in Tuscarora they were fitted to do most anything. With possibly one exception, none of these men had much more than a common-school education, nor did they inherit any fortune, but made their own opportunities and then hammered success out of them.



All that is left of the Navajo hoisting plant

Talc Mines Should Have Adequate Reserves

For the successful operation of a talc mine enough prospecting should be done before a mine is opened or a mill built to prove a large tonnage of talc of marketable grade, says R. B. Ladoo, mineral technologist, in Bulletin 213 of the Bureau of Mines. Probably 200,000 tons is a minimum safe reserve on which to start operations; 500,000 tons would be much better. Unfortunately, few companies in the past have done adequate prospecting; after some mills were built not enough talc was available to keep them running. When a definite tonnage has been blocked out and a mine opened, it is equally important that prospecting and development be continued so that a large supply of ore may always be blocked out, so that it will be available in advance of actual mining operations.

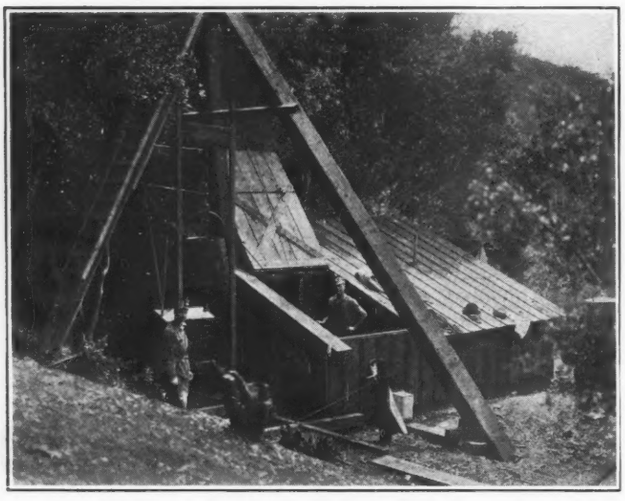
Students' Mine at Stanford

By Andrew R. Boone

UNDER the supervision of T. J. Hoover, executive head of the mining department of Stanford University, in California, and Welton J. Crook, professor of metallurgy, the Hermit mine, on the edge of the university campus, has been reopened by the students of the university, in an effort to convert the property into a practice mine. By their own efforts the students timbered cave-ins in the shaft, bailed out the water to a depth of 187 ft., installed a 40-hp. engine, built an engine house and constructed a triangular headframe.

"Spotting" the specimen

Money was furnished by the university to reopen and unwater the shaft, this work being done last December. New equipment was found necessary. The top of the shaft had caved, and a timber jam was found 20 ft. down. This was removed and a depth of 108 ft. was reached before winter rains made it impossible to continue. In the spring work was resumed. An examination of the shaft showed it to be well timbered and well lagged to the bottom, although loose rock and muck had fallen in from above. The lagging was chopped out and a vein from ½ to 12-in. wide uncovered. Samples were taken, the richest of which assayed 0.88 oz. of silver per ton, with a trace of gold. Small amounts of lead and zinc were also found. The students had hoped that some drifts or other horizontal works would be found, but none appeared except at the 63-ft. level, where a small crosscut had been attempted.



Hoist house and headframe built by Stanford University students in reopening Hermit mine on edge of campus

After the students prospected the property they prepared a topographic and geologic map and took samples of the surface prospects. They found that the silver assay obtained was 18 oz. per ton, with the average much less than 1 oz. Some specimens ran as high as 30 oz., with the galena concentrates up to 127 oz. silver per ton. Only a little gold was found.

The Properties of Electrolytic Zinc

The chemical, physical, and mechanical properties of zinc electrolytically deposited from zinc sulphate solution, and of about 99.9 per cent purity, have recently been investigated, and are reported in the *Zeitschrift für Elektrochemie* (Vol. 29, pp. 198-205).

According to an abstract appearing in *Chemistry and Industry*, the zinc crystals, during electrolysis, are deposited in directions normal to the cathode surface. A peculiar ring structure is exhibited by sections parallel to the latter. Electrodeposition occurs most readily at angles, corners, and rough parts of the cathode. The brittleness of electrolytic zinc is probably due to the presence of hydrogen, which in the sample investigated was found to be present to the extent of 0.55 per cent.

When electrolytic zinc is melted the hydrogen flame can be observed. When heated to 105 to 110 deg. C. for some hours a loss of weight of from 0.025 to 0.04 per cent occurs. A plate of zinc so treated becomes curved slightly, and a considerable volume of hydrogen is evolved. When heated to a temperature above 180 deg. C. the plate becomes very curved, the concavity being directly toward the original cathode surface. The phenomenon is accompanied by a decrease of 0.7 in the value of the density of the metal.

The electrical conductivity of electrolytic zinc is practically the same as that of pure zinc, but the value at 195 deg. C. is much below the anticipated value. This decrease and the decrease of density occurring at about the same temperature are not reversible phenomena, but are connected with the evolution of hydrogen. Determinations of hardness at high temperatures are in agreement with the customary values. Little if any hydrogen is dissolved in electrolytic zinc or electrolytic iron which has been stored for a long period.

Miscellaneous Uses for Waste Slate

Waste slate fragments may be utilized to some extent for sidewalk stone, building stone, and fence posts, states Dr. Oliver Bowles, mineral technologist, in Bulletin 218 of the Bureau of Mines. As slate presents an exceptionally satisfactory surface for painting, the use of waste slabs for sign boards merits consideration. Slate waste has been tried as railroad ballast, but the tendency for the flat fragments to slide on each other results in instability and gradual flattening of the grade. Consequently there is no prospect of finding any extended field of utilization in railroad work except possibly in the use of the larger massive fragments. Slate pulverizes to dust too readily for a road surface.

A Résumé of Copper Leaching in Australia

Most of the Work So Far Done Has Been on a Small Scale—The Nevill-Soanes Process the Most Radical

BY H. R. SLEEMAN

H. R. Sleeman

ALTHOUGH the leaching of copper ores on a commercial scale in Australia has advanced far less than in America, certain Australian experimental and small-scale work may be of interest and of suggestive value.

Provided that it can be made to regenerate its own acid, electrolytic deposition and sulphuric-acid leaching apparently constitute the most efficient treatment at most mines. The initial capital outlay is, however, high, and in localities where fuel is costly much of its advantage is lost. This treatment is therefore not under consideration anywhere at present. Nevertheless, some Australian work thereon is worthy of comment. The work done by E. DuFaur, of Sydney, is an instance.

DuFaur's investigations led to his believing that the best way to attack the problem is to divert a suitable portion of the electrolyte, to convert part of the iron therein to the ferric state and destroy all free acid by means of agitation with compressed air and manganese dioxide; then to agitate the hot solution with compressed air and finely divided cupric oxide. This results in fairly rapid precipitation of iron and alumina—as oxide and some as basic sulphate. About 50 per cent of each is suggested as suitable. The liquor is then returned to the cells stripped of half of its impurities and much strengthened in copper sulphate. Thus, further copper is deposited in the cells, acid is regenerated, and impurities are removed, including all the ferric sulphate. The manganese sulphate is converted in the cells to manganese dioxide and free acid. The former deposits on the anodes and can be collected and rinsed. Graphite anodes are used. To secure the cupric oxide he suggests that the requisite portion of electrolyte be bypassed and three-fourths of its copper precipitated by sulphur dioxide gas with heat and pressure. The copper is secured in a finely divided state, and twice the free acid is liberated that would be if the copper were deposited electrolytically. The copper is roasted to cupric oxide. Much fuller particulars are given in the April, 1920, issue of the *Chemical Engineering & Mining Review* (Melbourne).

A SUMMARY OF THE CORBOULD PROCESS

The Corbould process, developed by W. H. Corbould of Mount Elliott, includes a specially designed roasting furnace and leaching tanks and provides for ore containing appreciable quantities of carbonate of lime and magnesia. A calculated proportion of the electrolyte is bypassed, and milk of lime is added to neutralize acid and to precipitate some iron and other impurities. Cupric oxide is added to precipitate the remainder of the iron. The resulting copper sulphate solution is acidulated with bypassed electrolyte to 1 per cent acid, and sent to the cells. Graphite anodes are used—the low iron content of the electrolyte (0.2 per cent) permitting this—and sulphur dioxide gas introduced in the cells to depolarize the electrolyte. For each pound of copper deposited, 2.3 lb. of free acid is formed. All electrolyte holding 2 per cent copper is bypassed from the cells. Current efficiency is thus kept high, 3 lb. of copper being deposited per kilowatt-hour at current density of 12 amperes per square foot. The first wash solution, together with the remaining portion of the electrolyte, is treated with air and carbonate of lime, to neutralize the liquor and partly to precipitate iron and other impurities. The liquor is then agitated with milk of lime, precipitating the remainder of the iron and a little of the copper. After filtering, more milk of lime is added and all the copper precipitated as hydrate. The residue, copper hydrate, calcium sulphate, and a little iron, is agitated with ammonia—two parts to one of copper. The ammonia is recovered from the filtrate by steam; the copper precipitate is settled and the solution filtered and sent to coolers at the gas producer plant, where the calcium sulphate is concentrated. The last-named drops out and is made into pure plaster of paris. Part of the precipitate of cupric oxide is taken for purifying the electrolyte as described. The rest goes to a furnace, is heated in an atmosphere of water gas, and goes to a melting furnace, where it is made into fire-refined copper. The production of a high-grade copper slag is thus obviated. Residues from certain points in the process contain a little copper and go back to the furnace bins, where they join the ore. Other residues, containing calcium sulphate, are made into fertilizers. Some ammonium sulphate is formed, which is also sold as fertilizer.

It is claimed that sufficient acid for the leaching is regenerated once the treatment has started; also that enough ammonia is produced in the gas plant to make up for all losses, which are small. Thus all reagents are regenerated or made into byproducts; there are no foul solutions, no discarded solution and no copper tied up in unfinished products. The power is much less than that required to electrolyze the whole of the solutions from the ore charge. The whole treatment is effected at a warm temperature. The *Proceedings* of the Australasian Institute of Mining & Metallurgy, No. 42, 1921, contains a full description.

An obvious comment is that the commercial success of the process would depend partly on the local market for fertilizers. The utilization of graphite anodes is a great advantage, and it occurs to me that, if parts of these processes which permit this could be grafted

on to the Greenawalt process, a great step forward would be effected. The latter process appears to me to be the most promising, apart from its use of lead anodes. The use of graphite anodes would be of special value where fuel is costly.

Possibilities of the Pechey Process

G. A. Pechey's process consists of an endless circulation of liquor through ore heap, sulphur dioxide "converter," ore vats, and iron precipitation plant. In the dump, ferric sulphate is formed from the ferrous iron in the cementation tailing, and copper is dissolved. In the converter the ferric iron is supposed to be changed to ferrous and acid by the action of sulphur dioxide. The acid is used in dissolving copper in the vats.

Mr. DuFaur claims, and it is the experience at Whim Well, that in the converter ferrous iron and acid are also converted in the presence of air to ferric. Thus the main effect is to form acid and to leave the ferric iron more or less as it enters the converter. Thus, operated in the usual way, with much air mixed with the sulphur dioxide, the process has the defect of not destroying ferric iron previous to cementation. However, with cheap sulphur dioxide gas and by adding pyrite "filters," which convert ferric iron to ferrous iron and acid, this process is capable of good results, especially on a small scale, and can be established at small outlay.

The ability is also claimed of handling the sulphur dioxide gas and the solutions so that ferric iron and acid are created at will. This in some cases would greatly improve the process—notably where pyrite for "filters" was not available. Presumably the process would cease to be covered by Mr. Pechey's patent if utilized to produce ferric iron in the converter. It is improbable that this process will again be utilized at Whim Well. It was successfully applied by the inventor, and others, at Mount Hope. It was successfully operated in a technical sense at Whim Well, but lack of water prevented it being commercially successful.

According to Mr. DuFaur, he has recently perfected his treatment commercially. He claims to have the chemistry of the process under absolute control in every way; that he can entirely deplete the leaching solutions of their contents as desired and pick them up again at will; that he can make all the ferric sulphate required and use it without covering the particles of copper carbonate with a coating of ferric oxide, which prevents further chemical action, and which always takes place in sand-leaching where neutral ferric sulphate solutions are used.

Mr. DuFaur is operating his process at Burra Burra, South Australia. He obtains his sulphur dioxide by burning sulphur. Apparently, his investigations have convinced him that he cannot operate on the fume from roasting pyrite.

Another Method Devised by J. D. Audley Smith

At Mount Hope (N. S. W.) J. D. Audley Smith has evolved a process for treating soluble copper ore. The ore is crushed to, say, 60 mesh and is agitated in pachucas, or other suitable plant, with sulphur dioxide gas and air. The copper is precipitated on iron and the tailing liquor is returned to the leaching plant. In the presence of copper oxide the sulphur dioxide reacts with it and ferrous sulphate, forming ferric iron and copper sulphate. The ferric iron is again converted to ferrous and acid and so on. Tests on Whim Well ore indicated that at normal temperatures the copper was dissolved at a rate of about 1 per cent per five hours, the liquor being three to four times the quantity of the ore, and ordinary cementation tailing being used.

A defect is that the liquor leaves the leaching plant containing a substantial proportion of ferric iron. This must be corrected if good cementation is to be obtained. In a locality where pyrite is cheaply available, this correction can be efficiently made at low cost and sulphur dioxide gas can be produced cheaply. In such a place the process promises to give fair commercial results.

If the action in the leaching plant can be so controlled that the liquor leaves it practically free from ferric iron, the process would be much improved. Such a result should be attainable. It seems probable, too, that the leaching could be so controlled that excess of iron, in the form of the sesquioxide, would be precipitated and go to waste with the residues. A regeneration of solvent would then occur, and the consumption of sulphur dioxide be greatly reduced, only sufficient being required to start the cycle of reactions.

I infer that Mr. DuFaur's claims to be able to produce ferric iron or acid at will in such solutions would apply equally if ore were mixed with the liquor. The obvious procedure would be to form ferric iron in the first stages (or just ahead) of the leaching. The ferric iron and the copper oxide would form ferric oxide and copper sulphate. The former would remain undissolved until the more soluble copper went into solution, for the proportion of acid in the liquor never becomes high, being used up in dissolving copper as it is formed; the leaching ceases immediately the copper is dissolved. Very little iron, alumina, or other matter is dissolved from the ore, for similar reasons—the presence of iron sulphates and only weak acid. As the circulation of liquor is endless, there is no need to strip the copper to a very low point in cementation. Consequently the cementation plant need not be extensive; the grade of precipitate can be kept high and the iron consumption low.

It is regrettable that the plant erected at Mount Hope for this process has not been operated, for, had it been, useful data might have been collected. At Mount Hope the plant was erected for a "mixed" ore. For this ore, Mr. DuFaur evolved a process whereby flotation of the sulphide ore accompanied the leaching with sulphur dioxide. The original intention was to employ his process, but subsequently it was decided to float the sulphide ore separately and after the leaching. I understand that Mr. DuFaur still maintains that his process is the more efficient.

At Whim Well, it has been decided that other methods promise better results than the above-named process. An article appeared in the July, 1922, issue of the *Mining Magazine*, on the methods then proposed for that mine. The method therein outlined is partly similar in principle to the Pechey process, but substitutes vats of pyrite for sulphur dioxide converters, and provides for slime treatment.

In using the pyrite for increasing the solvent action of the liquor on ore heaps, two ways have been considered. One is to bypass a large part of the liquor from the floor of the ore heap, which contains a substantial proportion of ferric iron, back to the heap through vats of pyrite. The pyrite converts the ferric to ferrous iron and acid and increases the iron and the

sulphate radical in the liquor. The other is to pass all the liquor on to a slime or vat leaching plant and thence to cementation, but to increase the solvent power of the cementation tailing by means of pyrite. This would be done by operating vats of pyrite in parallel and continually alternating the flow of liquor through them, thus subjecting them to repeated floodings and drainings. The object is to promote rapid decomposition of the pyrite and thus to add acid and iron sulphate to the liquor. On the latter procedure only experimental work has been done, and no quantitative figures have been obtained. The experiments, however, have given promising results, and they will be continued with a view to securing quantitative data. They have already established the fact that a solution of ferrous sulphate, on being circulated through a body of oxidized ore (in a vat), through iron and through pyrite (alternatively flooding and draining, as said) back to the ore, will leach the ore. The procedure would be more efficacious applied to ore heaps than to ore in vats. The addition of a body of pyrite which is kept submerged between the ore and the iron improves the work by saving iron, by increasing the grade of the precipitated copper, and by adding to the sulphate element in the liquor, but is not necessary.

In the cycle proposed in the article mentioned, pyrite filters are placed between the ore heap and the slime plant, as well as ahead of the ore heap. The former filters would be used in parallel (alternatively flooded and drained) or simply submerged, according to the requirements. These depend mainly on the grade and quantity of slime to be leached—i.e., on the proportion of slime formed in crushing; which again depends on the nature of the ore and the fineness of crushing. The same factors would determine the extent of the pyrite plant if the alternating method were used.

The use of the submerged pyrite, as above detailed, is similar in principle to practice at Rio Tinto, where it is done in the form of a heap (filter bed) laid in a reservoir formed by a masonry dam across a small ravine. Joseph Irving, of Bisbee, has applied the principle in the form of specially designed vats (filters) both before cementation and before ore heaps.

Nevill-Soanes Process Has Unusual Features

Recently, new factors have appeared. One is that of precipitation with sponge iron. This has not been investigated in Australia, but it may enable cheaper precipitation, both in cost and size of plant, and in iron consumption. Another factor is the appearance of the new Nevill-Soanes process. This process is worth brief description here. Fuller particulars are in the August, 1922, issue of the *Mining Magazine*. It consists of agitating oxidized or roasted ore with sulphuric acid or ferrous sulphate and finely divided iron at a temperature of about 70 deg. C. The process has not been operated on the commercial scale, but experimental work has been effected over a long period. It is regenerative as regards the chemicals, and the cost of these per ton of ore is almost negligible. The consumption of iron is much less than in the usual iron precipitation. The work to date indicates a consumption of only half a pound of iron to a pound of copper precipitated, with ore of average composition.

The following formulas are quoted from the inventors as suggestive of what may be occurring. It is found that the use of ferrous sulphate alone is likely to develop defects. The addition of a little acid or a soluble chloride overcomes these. The formula therefore includes the use of sodium chloride:

1. $H_2SO_4 + 7CuO + 5Fe = 7Cu + FeSO_4 + Fe_2O_3 + H_2O$
2. $FeSO_4 + 3CuO + 2Fe = 3Cu + FeSO_4 + Fe_2O_3$
3. $H_2SO_4 + 7Cu_2O + 5Fe = 14Cu + FeSO_4 + 2Fe_2O_3 + H_2O$
4. $FeSO_4 + 3Cu_2O + 2Fe = 6Cu + FeSO_4 + Fe_2O_3$
5. $FeSO_4 + 2NaCl + 3CuO + 2Fe = 3Cu + Na_2SO_4 + FeCl_2 + Fe_2O_3$

It appears that the reactions can be obtained without chemicals if copper sulphate is present, thus:

$$3CuO + CuSO_4 + 3Fe = 4Cu + FeSO_4 + Fe_2O_3$$

but then consumption of iron is higher.

If such a substance as lime exists in the ore, it might interfere. It would no doubt react on the acid and perhaps on the iron sulphate. However, the reactions between the iron, copper, and the sulphate element appear to be so prompt and decided that it is probable that only a part of the lime would react—perhaps only a small part—before the copper is precipitated.

The whole operation of extracting the copper from the ore and its appearance as metal occupies only a few minutes. This assumes that the ore is finely ground, say 80 to 90 per cent through 150 mesh. I understand that practically all testing has been done on such material.

The action will take place at ordinary temperatures, but is much slower. At 70 deg. C. the action becomes rapid and violent, and it is estimated that it will pay far better to heat to this temperature than to treat at lower temperature.

The reactions have not yet been satisfactorily explained. There are good reasons to indicate that they are not the usual ones of dissolving copper and precipitating it on iron.

Small-Scale Experimental Results

A few indicative tests are interesting:

No. 1. A mixture of oxidized copper ore, water, ferrous sulphate, and metallic iron was formed into a ball of mud and allowed to stand for some time without heating. This on being washed off by panning gave an extraction of about 50 per cent of the total copper contents as metallic copper.

No. 2. The same result was obtained with a pulp containing slightly more water and allowed to stand in a vessel.

No. 3. A solid piece of oxidized copper ore containing no copper in the metallic state was placed in a beaker and covered with a solution of a ferrous salt together with some metallic iron filings. This was permitted to stand for from two to three weeks. The iron showed no sign of copper being precipitated on it, but the solid piece of ore, on being broken, distinctly showed small pieces of metallic copper inside, while the iron was apparently oxidizing. The metallic copper was seen over a quarter of an inch below the surface of the lump.

No. 4. Into a beaker some finely ground oxidized copper ore was placed with a mixture of water, ferrous salts, and sodium chloride. Some iron filings were tied in a muslin bag and suspended in the pulp. The whole was boiled for several minutes and although the violent reaction, obtained when mixing all the materials together, was not obtained, still a separation of the copper took place. A fair amount of high-grade metallic copper was deposited all round the outside of the muslin bag, whereas the iron inside the bag showed no sign of copper but did show distinct signs of oxidizing.

No. 5. Samples of pulp have been taken at short periods throughout the reaction, the solution filtered off and found to be entirely free from copper. This has been tested a great number of times.

These tests indicate a quite different reaction to that of dissolving plus precipitation.

Often almost a complete reduction of the copper content is obtained by using only one part of iron to two parts of metallic copper. However, in a series of tests on a roasted sulphide copper ore it was always found that, if the contents were roasted until, say, 90 per cent was soluble in 5 per cent sulphuric acid and contained, say, only 20 per cent of the copper in the water-soluble form, an equally high extraction could be obtained with a much reduced consumption of iron than if the contents were roasted to, say, 90 per cent soluble in 5 per cent sulphuric acid with 60 per cent or more of the copper in the water-soluble form. No increase in extraction was obtained by roasting to the water-soluble condition, and there was the disadvantage of using approximately one part of iron to one of copper for every unit of water-soluble copper.

Other acids or salts and reducing agents will effect similar results. In practice, however, ferrous sulphate, sulphuric acid, sodium chloride, and iron are the reagents that would be employed. The bulk of the experimenting has therefore been confined to these.

Sponge Iron To Be Used

The iron will be supplied as sponge iron. It is claimed that, if acid be used, its consumption is only one-fiftieth of the weight of copper recovered. If acid is not cheap at the place of operation, the introduction of a little sulphur dioxide gas suffices. The solution is used in a closed circuit, precautions being taken to retain its heat. It is claimed that it can be returned to the leach tanks at about 50 deg. C.; further, that on the ore pulp being heated to 70 deg., the chemical reactions carry the temperature to 90 deg. and that consequently the cost of heating is low.

The precipitated copper can be recovered by elutriation, but flotation is expected to give better results. On ore of from 3 to 5 per cent, an extraction of fully 90 per cent is expected. Experiments with flotation are reported as entirely satisfactory. Elutriation followed by flotation may give the best commercial results.

Experiments have indicated that among the best agents for floating the copper are the tar and distillate of the blackboy, (*Xanthorriaea*), a shrubby palm-like tree growing profusely in Australia, the products from which are cheaply obtained.

It was found that the finely atomized air caused a loss of salts in the flotation machine during flotation, and that the air had a tendency to oxidize the freshly formed metallic copper and to retard flotation somewhat. By passing a small amount of reducing gas (producer gas or coal gas) through the air-induction pipe or otherwise into the agitation chamber of the machine, this was entirely prevented and the flotation assisted.

Operated on a mine where heap leaching was being done, the ferrous sulphate could be secured in the form of cementation tailing at no cost. At Whim Well, where it is intended to do heap leaching and where sea water will be used, no chemicals would be required.

The use of this process at Whim Well is being considered. If adopted, it will first be used on ore which has all been ground to slime. A way in which apparently it could be used to special advantage, however, is in conjunction with heap leaching. The idea would be to coarse crush, the degree of coarseness depending on the grade of the ore, the higher grades being reduced to the smaller sizes. The coarsely crushed ore would be classified. The slime—say 30 to 50 per cent—would go to this process; the sand to the ore heap. Thus the cost of "all-sliming" would be saved and an ore heap of ideal character be formed. As heat is needed for the slime treatment, it would probably pay to heat the heap liquor at cementation. Thus, quicker cementation would be effected (meaning smaller plant) with little loss of heat, as part of the tailing liquor would go to the slime treatment. Again, it might suit to send heap liquor to the slime plant direct, or at least such part as would serve as make-up liquor. This would mean a smaller cementation plant. It is possible also that the copper in that portion of the heap liquor would thus be recovered cleaner, at lower handling cost, and with less iron consumption than in cementation. If this were done, the liquor recovered from the slime pulp would go to the ore heap as part of the make-up water.

It is claimed that the above-described process effectively recovers gold and silver with the copper and is applicable to the separation of copper from zinc and lead. It certainly appears to have special promise for the treatment of such copper-gold and copper-silver ores as are expensive to smelt and are amenable to leaching.

A new process is being tested on Whim Well ore in London. It, however, is not of Australian origin, and I am unaware of its details.

Lead and Zinc Pigments and Salts Marketed in the United States in 1922

Substantial gains over 1921 were made in the quantity of lead pigments marketed in 1922, as well as gains in the average price of most of them, according to figures compiled by C. E. Siebenthal and A. Stoll, of the Geological Survey. Notable increases were made in the sales of all zinc pigments and salts except zinc chloride, but there was a falling off in the average price per ton. The largest output of zinc oxide made in the history of the industry was recorded, the gain amounting to 73 per cent over the output in 1921. The table gives the quantity and value of the respective materials:

	1921			1922		
	Short Tons	Value		Short Tons	Value	
		Total	Per Ton		Total	Per Ton
Sublimed lead (*a*)						
White	11,568	$1,418,403	$122.61	13,765	$1,829,865	$132.94
Blue	463	58,593	126.55	972	129,230	132.95
Red lead	21,814	3,410,904	156.36	30,509	5,104,901	167.30
Orange mineral	379	91,184	240.59	370	83,022	224.38
Litharge	41,953	5,740,690	136.84	58,261	8,892,172	152.63
White lead:						
Dry	26,695	3,749,851	140.47	41,598	5,785,165	139.07
In oil	143,634	27,713,257	192.94	153,393	29,728,230	193.80
Zinc oxide	74,329	11,231,716	151.11	128,465	17,994,704	140.07
Leaded zinc oxide	16,103	2,092,320	129.93	19,613	2,251,601	114.80
Lithopone	55,016	6,681,563	121.45	83,360	9,214,040	110.53
Zinc chloride	59,457	3,552,619	59.75	41,627	2,009,147	48.27
Zinc sulphate	3,295	189,369	57.47	5,078	251,528	49.53

(*a*) Includes basic sulphate lead.

To Increase Greek Emery Production

It is reported in *Chemistry and Industry* that the Greek Government has decided to construct works at Naxos, at a cost of £30,000, to facilitate the mining and transport of emery ore. The works will, it is estimated, be complete within a year and should result in increasing the annual production to roughly 20,000 tons.

Weight of Steel Balls

Incorrectly Given as 256 Lb. per Cu.Ft. in Published Data—Should Be 363

By Donald H. Fairchild
Mining and Metallurgical Engineer, Denver, Colo.

DUE, PROBABLY, to its apparent lack of importance and the limited use to which the figure is put, the weight of a cubic foot of steel balls has always been misstated. I have never seen the weight stated other than 256 lb. per cubic foot. During some recent research in ball milling I was impressed by the discrepancy between the accepted weight and what seemed logical to expect. It did not seem reasonable to me that there could be 48 per cent of voids or interstices, and investigation proved that such a percentage did not exist. The error has been due to not considering the natural arrangement of balls of the same size when piled.

The erroneous estimate of weight was derived by dividing the volume of the ball by the volume of its circumscribed cube and considering the result as the percentage of solid matter. It will be readily seen that for this method to be correct the balls would have to arrange themselves as in Fig. 1, and, furthermore, the balls would have to be of such a size that they would

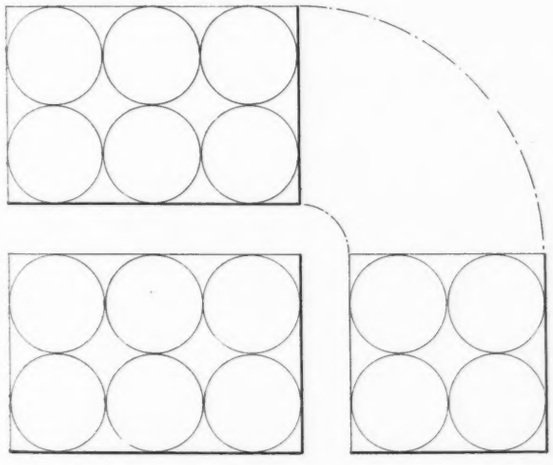


Fig. 1

just fit into a box of one cubic foot capacity, all balls being whole. This arrangement is artificial and not natural. The ball occupies 52 per cent of the space within the cube circumscribed about it, the 48 per cent representing the eight corners. In the arrangement indicated in Fig. 1 there are eight cubes with one of their corners located at the center of the large space between the balls, thus accounting for the 48 per cent of voids.

The proper and natural arrangement of balls of the same size is indicated in Fig. 2. In order that a true determination of the weight of the balls per cubic foot may be made, planes must be passed through the centers of the balls in such a manner that the space within the planes is filled with balls and regular sections of balls as they lie in their natural positions. Fig. 2 indicates the result of passing the planes through the balls, the total of the whole and fractional balls making up twelve whole ones.

By determining the value of *B-B* in Fig. 2, the cubical content of such a solid may be computed, and knowing the number of balls and their total cubical content, it is a simple matter to arrive at the proper weight per cubic foot. The method of determining *B-B* is as follows:

In Fig. 3 the diagonal $C = d\sqrt{2}$.

Taking a section through *A-A* as indicated by Fig. 4 and solving for h by right triangles:

$$h = \sqrt{d - \frac{C^2}{2}} = \sqrt{d^2 - \left(\frac{d\sqrt{2}}{2}\right)^2} = \frac{d}{\sqrt{2}}$$

The per cent of depth, b, in terms of the diameter, is $d - \frac{d}{\sqrt{2}} = \frac{d\sqrt{2}-1}{\sqrt{2}} = 29.2$ per cent of the diameter of the balls.

As the planes that bound the solid considered in Fig. 2 pass through the centers of the balls, and as one

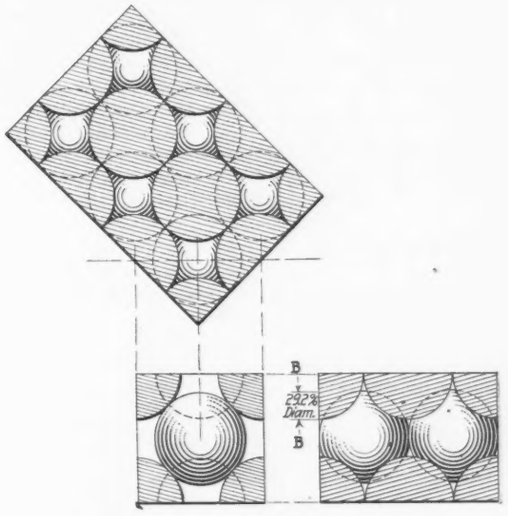
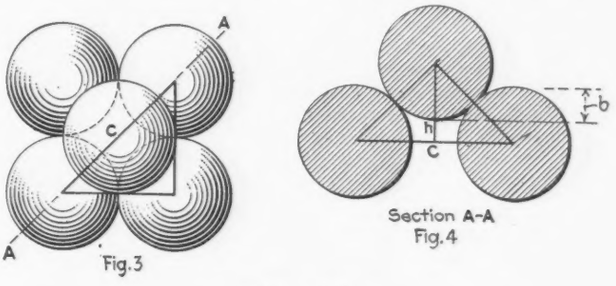


Fig. 2

knows the diameter of these balls and the distance b (Fig. 4) and the volume of the size ball making up the figure, one can easily determine the relative volumes of balls and voids.

Considering any size of ball, it will be found that the twelve balls in Fig. 2 make up 74 per cent of the



Figs. 3 and 4

volume of the figure, the balance of 26 per cent being the voids. Applying these results to a cubic foot, a cubic foot of steel balls should weigh 363 lb. To prevent error in the future, texts, notes, and catalogs should be corrected.

USEFUL OPERATING IDEAS

How They Rope Pack Loads in Colombia

A Method Superior to That Taught at West Point and Often Used in This Country

BY JOHN KRUTTSCHNITT

THE PEOPLE of Colombia are of necessity largely dependent upon the pack animal for transportation, owing to their country's lack of internal improvements, and consequently many of them are very adept in the roping of pack loads. The animals employed by them to bear freight are donkeys, oxen, mules, and horses, the packer's pride being the Antioquian mule, a well-favored breed of about the same size as a polo pony, and for the purpose, I suppose, without a superior in America.

When I was in Medellín, the capital of the Department of Antioquia, which, being the commercial

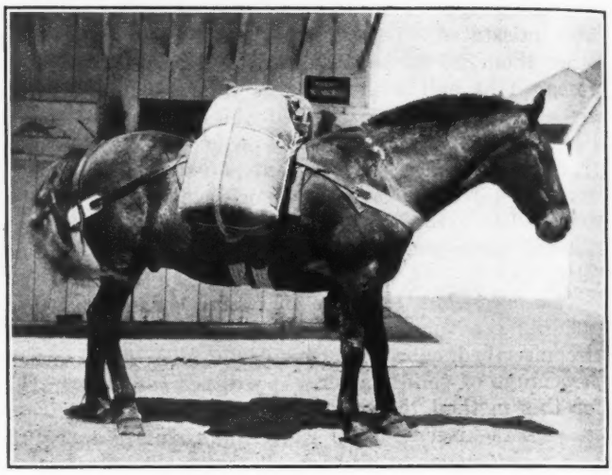
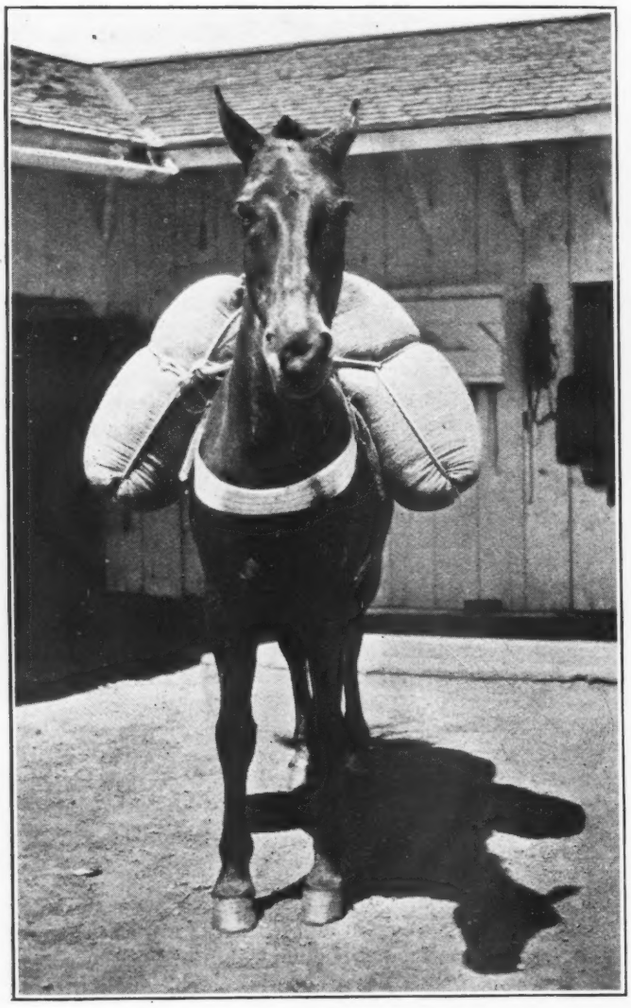
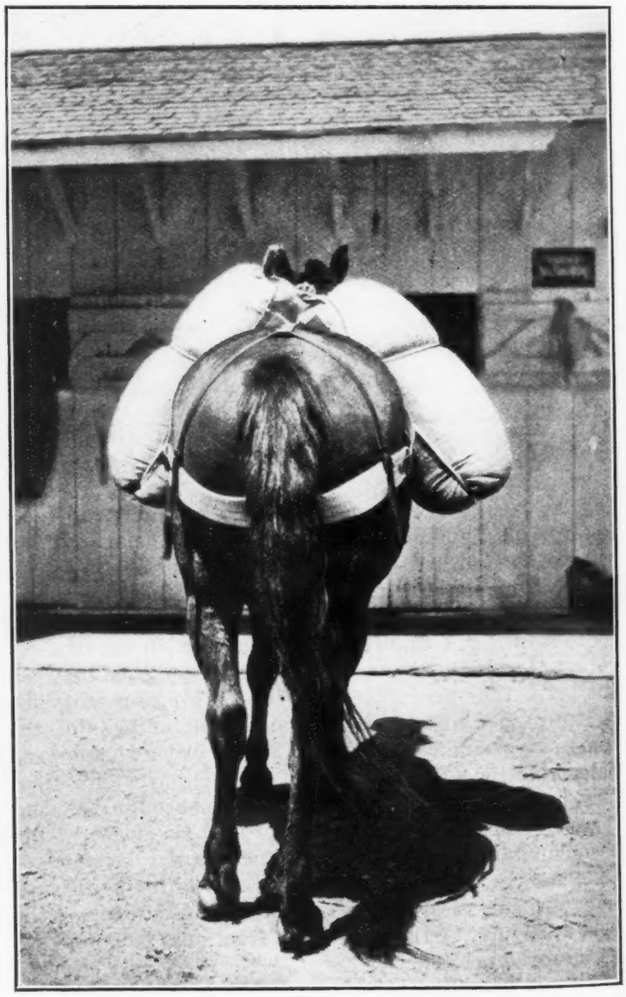


Fig. 3—Packs lashed with Colombian hitch





Figs. 1 and 2—Packs slung on horse in Colombian fashion

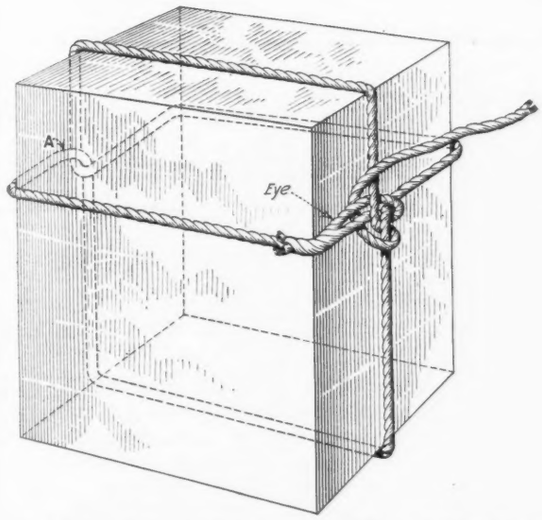


Fig. 4—Sling rope on one pack ready for tightening

metropolis, is also the pack-trail center of the country, I made it a point to learn the Colombian method of packing. Apparently, the *aparejo* was the style of pack saddle mostly used by the *cargadors*. Their hitch is practically the same as our crosstree hitch, but the packs are slung in a manner which, when they are regular in shape, is, in my opinion, so much better than the one taught at West Point and commonly followed in this country, that I recommend it specially to the reader's attention. My opinion, incidentally, is founded largely upon the satisfaction that a trial of it by myself has afforded. Referring to the illustrations, Figs. 1 and 2 show sacks of feed slung on a horse this way, and Fig. 3 shows them lashed with the Colombian hitch.

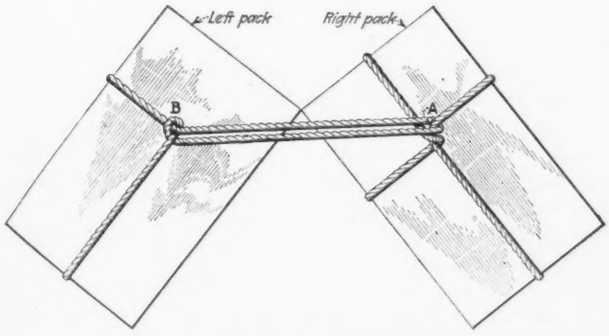


Fig. 5—Packs viewed from rear

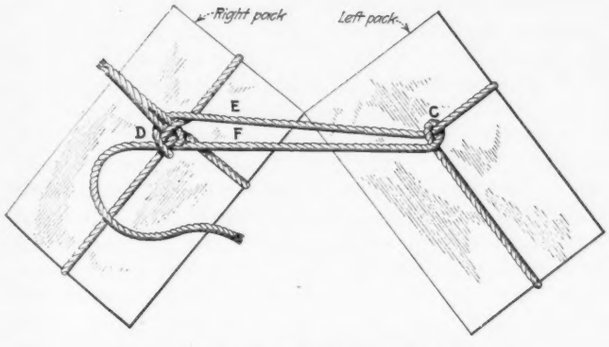


Fig. 6—Packs viewed from front

After an eye or loop has been made on one end of the sling rope, the procedure for slinging the packs begins with its being fastened around one of them, as indicated in Fig. 4. This represents a box-shaped pack with the sling rope around it ready to be tightened, the dotted lines indicating the parts of the box and rope which would be invisible were it an actual pack. This pack should be put on the right side of the animal.

When it has been lifted into place the unused part of the sling rope (which does not appear in this figure) is passed horizontally around the other pack, which now likewise should be in place, and then downward around the part denoted *A*. Fig. 5 shows the packs in their correct relative position viewed from the rear. After pulling the rope taut the loose part is formed into a half-hitch around the part connecting the packs, in the middle of and behind the left pack, as shown at *B*. In making this and the other half-hitch in front of the same pack (at *C* in Fig. 6) it should be bent up on the outside, then down between the tightened part and the pack. In passing from *B* to *C* across the bottom of the pack the rope should be over the middle. From *C* it passes back to the right pack, where a turn is taken, outward from the pack, around the intersection at *D*, below the eye. The procedure is next completed by making the rope fast around the parts *E* and *F* in some suitable manner such as by two half-hitches.

Unwatering a Mine Shaft

Unwatering a shaft 125 ft. deep with the aid of an auto for hoisting the bailer is described by H. R. Van Wagenen in a recent number of the *Colorado School of Mines Magazine*. The hoisting equipment had been removed and only the headframe and sheave were left over the shaft.

A 50-gal. iron sinking bucket and 250 ft. of ⅞-in. wire rope were rented. A hinged trough and a dumping chain were rigged at the proper elevation in the headframe. The cable was attached to the channel-bar frame of the car. The cactus and brush were cleared to make a runway upon which the auto could travel forward and backward to and from the headframe. The car was faced toward the shaft so that it would be in reverse gear when raising the load. Rocks were put in the tonneau to weigh down the rear wheels. The headlights, together with a shielded lantern in the headframe, provided adequate illumination for night work. A laborer at the dumping trough was the only hand required besides the auto driver.

Thus equipped and manned, operations were begun. Without slipping, the car was able to raise the fully loaded bucket of 500 lb., including the cable, and would do it very smoothly if the bucket were submersed a couple of feet before being raised, thus giving the car a start before the bucket reached the surface of the water. Having raised the bucket into the headframe, the dumping chain was attached to the ring under the bottom of the bucket, the load eased down, dumped, and picked up again, all without a shift of gears. (The weight of the bucket was sufficient to move the car back toward the shaft.) Then, to hasten matters, the gear was shifted into forward, low, a kick-off given, and the car coasted and was braked as the bottom was approached.

The dirt runway was sprinkled every hour for the first six, and then every two hours. A hard-packed road was made and maintained.

THE PETROLEUM INDUSTRY

Petroleum Production Continues at Fast Rate

The American Petroleum Institute estimates that the daily average gross crude-oil production in the United States for the week ended July 21 was 2,255,950 bbl., compared with 2,238,750 bbl. for the preceding week, an increase of 17,200 bbl. The daily average production east of the Rocky Mountains was 1,404,950 bbl., compared with 1,370,750 bbl., an increase of 34,200 bbl. In the accompanying table are estimates of daily average gross production for the weeks ended July 21 and July 14, 1923, and July 22, 1922.

Daily Average Production

In Barrels

	1923		1922	
	July 21	July 14	Difference	July 22
Oklahoma	500,200	503,850	Dec. 3,650	414,500
Kansas	84,200	84,650	Dec. 450	84,550
North Texas	73,900	75,550	Dec. 1,650	49,900
Central Texas	194,300	175,250	Inc. 19,050	146,900
North Louisiana	62,000	62,500	Dec. 500	94,800
Arkansas	135,250	122,500	Inc. 12,750	31,650
Gulf Coast	102,400	102,150	Inc. 250	99,750
Eastern	113,500	113,000	Inc. 500	117,000
Wyoming and Montana	139,200	131,300	Inc. 7,900	84,450
California	851,000	868,000	Dec. 17,000	375,000
Total	2,255,950	2,238,750	Inc. 17,200	1,498,500

California's production was 851,000 bbl., compared with 868,000 bbl., a decrease of 17,000 bbl. Santa Fe Springs is reported at 322,000 bbl., against 327,000 bbl.; Long Beach, 202,000 bbl., against 204,000 bbl., and Huntington Beach, 115,000 bbl, against 126,000 bbl.

The estimated daily average gross production of the Mid-Continent field, including Oklahoma, Kansas, North Texas, Central Texas, North Louisiana and Arkansas, for the week ended July 21 was 1,049,850 bbl., compared with 1,024,300 bbl. for the preceding week, an increase of 25,530 bbl. The Mid-Continent production, excluding Smackover, Arkansas, heavy oil, was 957,900 bbl., against 941,150 bbl., an increase of 16,750 bbl.

The estimated daily average gross production of the Gulf Coast field was 102,400 bbl., compared with 102,150 bbl. for the preceding week, an increase of 250 bbl.

The combined daily average gross production of the Southwest field was 1,152,250 bbl., compared with 1,126,450 bbl. for the preceding week, an increase of 25,800 bbl.

Drilling Near Coutts, Alta., Not Encouraging

A. W. McQueen, vice-president of the Imperial Oil Co., recently returned from an inspection of the well near Coutts, Alta. He stated that the results were not encouraging, except so far as the discovery of even small quantities of oil was important as an indicator. The flow of oil was drowned out by water, and baling was in progress. Until the well was clear of water no definite statement in regard to it could be made.

Fourteen hundred men are engaged in the construction of the new refinery of the company in Calgary, which will have a 3,500-bbl. capacity and will cost over $2,000,000.

Soviet Gets Oil Proposition from American Companies

According to press reports from Moscow, an important proposition has been made to the Soviet Government jointly by the Sinclair Consolidated Oil Corporation, the Barnsdall Corporation, and the International Barnsdall Corporation, through the respective presidents of these companies, Harry F. Sinclair, Robert Law, Jr., and Harry Mason Day. "I came to Russia at the invitation of the Russian Government, primarily to discuss operations of the Sinclair Consolidated Oil Corporation under its concession granted some time ago for development of petroleum resources in northern Sakhalin," Mr. Sinclair said. "The general oil situation presents a number of problems, all of which, however, can satisfactorily be solved, provided proper business methods are used and sufficient co-operation is obtained."

Prospecting for Oil in Queensland

A definite move ahead has just been made by the Australian Oils Corporation, the company having its chief activities at Beaudesert, about 50 miles south of Brisbane. The manager and secretary of the company (R. W. Stringer), who lives in Melbourne, Victoria, where he promoted the company, has lately visited the Beaudesert leases and spent two or three weeks in Brisbane. From personal inspection and information obtained concerning the geological indications of the district, as well as from the fact that crude petroleum has undoubtedly been found in samples taken from what is known as Dunn's well, where the oil indications were first found, he claims to be satisfied. The company intends to purchase a diamond drill and put down a test hole near this well, which will be followed by other bores, possibly up to ten or more of a similar type, and which can, if necessary, be taken to a depth of 1,000 to 1,500 ft. Mr. Stringer will organize a geological field staff, and have a thorough survey made of the country included in the prospecting areas, with a view to mapping its geological structure.

Another oil prospecting company operating near Brisbane—on the coast 80 miles north of Brisbane—is the Queensland Coastal Concessions. The company started a prospect hole which was taken to a depth of 217 ft., and the driller got into difficulties through a heavy flow of artesian water. H. I. Jensen, late of the Queensland Geological Survey, who was called in to advise, condemned the site of the bore. Although crude oil has been found in the well, Jensen points out that, since it is within a syncline, water might be expected instead of oil at all depths, and that it is, for this and other reasons, very unfavorable. The geologist upon whose advice the hole was begun says the general geological structure of the region is favorable and recommended another site for the drill 650 miles north of the present one, and the plant is now being moved to the new site.

Recent Technical Publications

Reviews, Abstracts, and References

Oatman Geology—Bulletin 743 of the U. S. Geological Survey, Washington, D. C., 58 pages, obtainable on request, is entitled "Geology of the Oatman Gold District, Arizona." The field work on which the report is based was done early in 1921. Two years ago it was thought that little more ore was available in the district, but further discoveries have encouraged drilling. The present report is offered as an aid to the further development. Individual mines and prospects are not described in any detail. It is the opinion of the author, F. L. Ransome, that additional orebodies are likely to be found at moderate depths, but that extensive exploration at depths greater than 1,500 ft. is not warranted. In this district there is little surface indication of which ore deposits are likely to be profitable at depth.

Mining at Broken Hill—"The Great Broken Hill Mines in Australia" is the title of a four-page article in the *Compressed Air Magazine* for July (11 Broadway, New York City; price, 35c.). The method of mining is described. When the crosscuts have reached the orebodies, sill floor stopes are started, which are carried 9 ft. high and extended to the walls of the orebodies. Ordinarily, in the open-stope practice which is followed, timber balks of 10x10-in. Oregon pine are built at regular intervals of 12 ft. or so to act as temporary supports of the roof, but where the ground is weak, square sets may be built. The article will be concluded in the August issue.

Poisonous Hydrogen Sulphide — The U. S. Bureau of Mines, Washington, D. C., has issued a six-page bulletin on "Hydrogen Sulphide as an Industrial Poison." (*Reports of Investigations*, No. 2,491; obtainable on request.) This gas may occur in mines, smelters, sulphuric-acid plants, laboratories, and in petroleum distillation plants, and is decidedly toxic, being comparable to hydrocyanic acid gas (prussic acid) in this respect. Its effects and methods of treatment for affected persons are given.

C. & H. Turbines—In *Power* of July 3 (10th Ave. at 36th St., New York City; price, 15c.) is a three-page article describing the large mixed-pressure turbines which utilize the exhaust steam from the steam stamp mills of the Calumet & Hecla company, at Lake Linden, Mich.

Mineral Resources — "Petroleum in 1919-1921," 80 pages, a separate chapter of "Mineral Resources" for 1921, is now available from the U. S. Geological Survey, Washington, D. C., on request. "Gold, Silver, Copper, Lead, and Zinc in the Eastern States in 1922," eight pages, has also recently been issued.

Copper Deposits—The monograph on "Copper Ores" recently issued by the Imperial Institute is more pretentious than any other similar report so far issued. It resembles in scope the other monographs of the series, covering the occurrence, character, and uses of the various copper minerals in the opening chapter, with the rest of the book devoted to brief description of the copper deposits of the world, classified by countries. There is also a bibliography of nearly 300 important articles and books on copper. Obtainable for 7s. 8½d. from the Imperial Institute, London, S. W. 7, England.

Alaska Juneau—In the *Pacific Mining News* for July (Rialto Building, San Francisco) appears a five-page article descriptive of the system of milling at the Alaska Juneau plant. About 57 per cent of the ore as it comes to the mill is removed by hand-sorting. Concentration and amalgamation is then carried out, the mill product being gold bullion and lead concentrates.

Reduction of Iron Oxides—"The Reduction of Iron Oxides by Fuel Gases" is the subject of a 14-page paper published by the U. S. Bureau of Mines, Washington, D. C., as *Reports of Investigations* No. 2,485, obtainable on request. The report presents the theory and results of experimental work conducted at the Southwest station of the Bureau, and is of interest to students of the subject of sponge-iron production.

Molybdenum Minerals—"Ilsemannite at Ouray, Utah," is discussed in U. S. Geological Survey Bulletin 750-A, 16 pages, obtainable on request. The mineral is molybdenum in soluble form—probably molybdenum sulphate. The report gives an account of the discovery and character of the Utah deposit and also a review of other known occurrences of the mineral.

Motor Trucks—The U. S. Bureau of Mines has improved its motor-truck mileage per gallon of gasoline 22 per cent by analyzing exhaust gases and adjusting the carbureters properly. The essential determinations were not difficult to make. The whole story is in *Reports of Investigations* No. 2,487, 13 pages, obtainable free from the U. S. Bureau of Mines, Washington, D. C.

Sodium Sulphate—Bulletin 717 of the U. S. Geological Survey is entitled "Sodium Sulphate: Its Sources and Uses." The bulletin, which is of 43 pages, describes the occurrence and physical and chemical character of sodium sulphate minerals, giving details of the various deposits in this country, names of producers and consumers, and the methods used in the preparation of the material for the trade and its employment in industry.

Patents

Ball Pulverizer—No. 1,452,786. F. A. Brewer and G. W. Branston, Vancouver, B. C. F. A. Brewer assignor to F. A. Brewer, Jr., Vancouver, B. C. A crusher consisting of balls revolving in concentrically grooved rings, the upper and outer rings carrying balls larger and heavier than the inner and lower grinding compartments, which are used for finishing.

Zinc-Lead Separation—No. 1,453,289. May 1, 1923. E. H. Snyder, Salt Lake City, Utah. Zinc-lead ore containing sulphur is roasted to the sulphate of lead and zinc oxide, and then mixed with the chloride of an alkali-forming metal in amount at least chemically equivalent to the amount of lead compound present. The mixture is then heated in a non-reducing atmosphere to a temperature between 750 and 1,100 deg. C., whereby the lead is converted into the chloride, volatilized, and collected, leaving the zinc oxide behind.

Phosphate Rock—No. 1,453,571. May 1, 1923. E. P. Stevenson, Newton, Mass. Crude pebble phosphate is heated to a temperature not over 2,000 deg. F. to decompose the calcium carbonate and cause a substantially complete conversion of the resulting free lime.

Refractory Material in Smelting—No. 1,453,993. May 1, 1923. Calvin Payton, Douglas, Ariz., assignor of 55/100 to the Phelps Dodge Corporation, New York. The process of making a metallurgical refractory material by blowing copper matte without the addition of silica, and separating the resulting slag.

Cottrell Process—No. 1,453,325. May 1, 1923. W. A. Schmidt, Los Angeles, assignor to International Precipitation Co., Los Angeles. Means for striking a blow against the electrodes used in the Cottrell precipitator, to loosen the adhering dust.

No. 1,454,255. May 8, 1923. C. H. Weiskopf, Santa Monica, Calif., assignor to International Precipitation Co., Los Angeles. A method of vibrating the electrodes used in the Cottrell process.

No. 1,454,256. May 8, 1923. H. A. Wintermute, Branchville, N. J., assignor to the Research Corporation, New York City. Means for swinging the discharge electrode, which is flexible, into contact with the collecting electrode.

Tube Mill — No. 1,453,406. May 1, 1923. J. P. Ruth, Jr., Denver. A tube mill with a discharge end of special design, embodying a splash door.

No.1,454,491. May 8, 1923. E. C. Soper, Chattanooga, Tenn. A dry tube mill discharges into a closed vessel, from which one pipe allows the heavier particles to discharge and another carries the dust upward into a suitable collector. The discharge from the collector then unites with the other material coming from the mill.

Rock Drill—No. 1,452,582. April 24, 1923. C. R. Welch, Denver, Colo. A new design for a hammer drill.

SOCIETIES, ADDRESSES, AND REPORTS

Idaho Bureau Has Problems of Diverse Nature

Summer Plans Call for Much Geological and Metallurgical Work

The activities during the present summer of the staff of the Idaho Bureau of Mines and Geology illustrate the widely varying nature of the mineral resources of the state and the diversity of interest with which the bureau has to concern itself. The work which is perhaps attracting the greatest popular interest is that having to do with the oil possibilities of the southeastern part of the state. Here two parties are doing work, one in the Bonneville-Caribou area, east of Idaho Falls and north of Soda Springs, under the direction of Prof. Virgil R. Kirkham. This party is engaged in mapping the structure of the beds, which, in parts of Wyoming, have been large producers of oil, and which at suitable places, to be determined by this survey, would seem to justify prospect drilling in Idaho. The other party, under the direction of A. M. Piper, is making a reconnaissance survey of the oil possibilities in Power and Oneida counties.

S. M. Ballard has recently completed three weeks of field work in Idaho County, which is designed to supplement the data collected by Francis A. Thomson and Mr. Ballard, during the last three years. Dr. Thomson has also completed a brief reconnaissance in the Pierce City country. All of the material under this head is soon to be embodied in a bulletin which will probable be entitled "Geology and Gold Resources of North Central Idaho," to be issued this fall. Mr. Ballard is now completing the field work and laboratory studies for a similar bulletin on the "Geology and Gold Resources of the Boise Basin."

Dr. F. B. Laney will shortly conclude the field work in the Seven Devils and adjacent areas, preparatory to publishing a scientific publication of the genesis of the copper ore deposits of this important region.

D. C. Livingston is completing a study begun three years ago on the ore deposits of the Cuddy Mountain and adjacent areas. Professor Livingston's work is expected to result in a bulletin on this area to be published by the Idaho Bureau during the coming winter.

Clyde P. Ross is completing and correlating the work done in previous years in the Hailey area by Messrs. Umpleby, Westgate, and others, and it is anticipated that a bulletin including all of this work will be issued by the survey early in the spring. Upon the completion of his work at Hailey, the program for Mr. Ross provides for his making a reconnaissance survey of the copper deposits in the immediate vicinity of Salmon City, in Lemhi County, Idaho.

As a part of the metallurgical work done in co-operation with the U. S. Bureau of Mines, A. W. Fahrenwald is conducting, in co-operation with the Bunker Hill & Sullivan, extensive experiments in the development of a new type of classifier. This was developed jointly by Mr. Fahrenwald and the late R. B. Elder, and has given such successful preliminary results that a 150-ton unit is being completed by the Bunker Hill company for experimental demonstration and application on a large scale.

East Tennessee's Zinc and Iron Deposits Being Studied

The Tennessee Geological Survey has just completed reports on the zinc deposits of east Tennessee, by Dr. Singewald and Mr. Secrist, of Johns Hopkins University; a report on the magnetic iron ores of east Tennessee, by Dr. C. H. Gordon, Dr. T. N. Dale, and Oliver Bowles, and a report on the small undeveloped water powers of Tennessee, by Prof. J. A. Switzer. The geological map of the Franklin Quadrangle, by Dr. R. S. Bassler, is being printed.

The survey recently published its third edition of the geologic map of Tennessee, which shows in detail over 90 per cent of the geology of the state. The compilation of this final edition was under the direction of Wilbur A. Nelson, the State Geologist.

During this summer R. S. Bassler has been in the field working on the geology and stratigraphy of the middle Tennessee basin, and on mapping the geology of the Hollow Springs Quadrangle; E. F. Burchard, of the U. S. Geological Survey, has been working co-operatively with the state on the brown iron ores of the western highland rim; R. E. L. Collins, of Johns Hopkins University, is doing detailed areal mapping of the Eocene formations of west Tennessee and making a study of any oil possibilities in that section; J. H. C. Martens, of Cornell University, is making a study and collecting samples of molding stands of west Tennessee; and R. W. Smith, Assistant Geologist of the Tennessee Survey, is making a detailed report on the phosphate deposits of the state.

The state has just completed, in co-operation with the U. S. Geological Survey, topographic sheets of the Lillydale Quadrangle and the Reelfoot Lake Quadrangle.

Michigan Geological Survey Busy

Resources of State Being Inventoried by Counties—Report on Oil Possibilities in Preparation

The Michigan State Geological Survey is engaged in making soil and geological studies in co-operation with the Land-Economic Survey now being conducted under the direction of John Baird, director of the Department of Conservation. This work is being carried on in two counties, and contemplates an inventory of all the resources of the state, to be cataloged by counties.

An inventory of the clays and shales of Michigan is just being completed, and the final report probably will be ready for the printer by the close of the year. Likewise an inventory of the foundry sands of the state was started in July. A restudy of the stratigraphical conditions and relations of the Paleozoic formations of the state is being made, as well as special studies of the iron and copper-bearing districts. The Paleozoic studies include a re-examination of thousands of well samples and hundreds of well records. The iron and copper studies are being conducted by districts. A detailed report on the Menominee iron district is being completed. This probably will be ready for the printer some time during late winter or in the early spring of next year.

A report on the oil and gas possibilities has been under way for the last year, but probably will not be completed before the coming winter. This work is under the direct supervision of the State Geologist, R. A. Smith.

A considerable part of the time of the State Geologist is taken up with mine and oil investigations for the Michigan Securities Commission, and in consultation on the water problems and development of the mineral resources of the state.

Petroleum Geologists to Meet in Los Angeles

The American Association of Petroleum Geologists will meet in Los Angeles Sept. 20 to 22, inclusive. Papers on all of the important California fields will be presented by geologists and oil men. Because of the importance of the California oil situation, this meeting promises to be more than a gathering of technical men, as an invitation has been extended to all oil operators throughout the country to participate in the business and discussion of the meeting.

MEN YOU SHOULD KNOW ABOUT

R. G. **Hall** is in St. Louis.

R. A. **Hardy**, of Gold Hill, Nev., is at Santa Cruz, Calif., on a vacation.

Alex Wise and H. Humphries, of Virginia City, Nev., were recently in San Francisco.

Oliver E. Jager has accepted a position with the Sumpter Valley Smelter Co. at Sumpter, Ore.

Henry Crumb and his wife sailed on the "Shinyo Maru" from San Francisco on July 24, on a tour of the world.

F. E. **Calkins**, of Globe, Ariz., has recently completed the examination of several mines at Randsburg, Calif.

A. W. **Allen**, assistant editor, *Engineering and Mining Journal-Press*, was recently in Los Angeles and Long Beach, Calif.

R. K. **Neil**, a well-known Spokane mine operator, who discovered the Premier mine, is now at Funter Bay, Admiralty Island, Alaska, developing a property.

George J. Young, associate editor, *Engineering and Mining Journal-Press*, has returned from Virginia City, Nev., to San Francisco.

M. W. **von Bernewitz** has completed the preparation of the U. S. Bureau of Mines report on losses in mining coal, for the U. S. Coal Commission, and has returned to the Pittsburgh Experiment Station.

Dr. **Oliver Bowles** has taken up his duties as mineral-technologist at the Rutgers station of the U. S. Bureau of Mines, at New Brunswick, N. J. He will be assisted by **W. M. Myers**, who comes from the Pittsburgh station.

Senator Tasker L. Oddie, of Washington, will head a delegation from the Washington section of the A.I.M.E., which will attend the 128th meeting of the Institute to be held Aug. 20 to 31 in Ontario and Quebec.

A. G. Larsen, of Spokane, is at the Fish Creek mine, in the Salmon River district of Alaska, and will locate the position for the main haulage tunnel, which the American Mining & Milling company is about to drive. **W. R. Tonkin**, vice-president of the company, also is at the mine.

D'Arcy Weatherbe, British mining engineer, has been captured by bandits near Chiuho, Province of Yannan, China, according to a recent customs report. He was attempting an overland route from Burma to Peking through country never before traversed by white men. Mr. Weatherbe is a native of Halifax and is a son of the late Sir Robert **Weatherbe, former** Chief Justice of Nova Scotia.

Dr. Willard Rouse Jillson, Director of the Kentucky Geological Survey and State Geogist, was recently elected president of the Kentucky Academy of Science and is now engaged in editing

Dr. Willard Rouse Jillson

the first volume of its *Transactions*. Dr. Jillson has written extensively on the geology of his state and as well as upon general subjects unrelated to his profession.

OBITUARY

Horace Vaughn Winchell

Horace V. Winchell died at Los Angeles on July 28, after a short illness. The immediate cause of death was heart failure. Mr. Winchell had been in Butte, Mont., on professional duties connected with the Davis-Daly Anaconda litigation. He was compelled because of serious indisposition to return to Los Angeles on July 26, and the end came two days later. The funeral was held on the afternoon of Aug. 2 in Minneapolis, from the home of his sister, Mrs. D. Draper Dayton, and the interment was also at Minneapolis.

Horace Vaughn Winchell was born in Galesburg, Mich., on Nov. 1, 1865, the son of Newton Horace Winchell and Charlotte Sophia (Imus) Winchell, he being of American stock and ancestry since 1634. His father, a distinguished geologist and archaeologist, died in 1914. Horace V. Winchell received his education at the University of Minnesota and the University of Michigan, being graduated from the latter institution in 1889. The following year he married his cousin, Ida Belle Winchell, daughter of Prof. Alexander Winchell, of the University of Michigan, a geologist of great reputation and widely recognized ability and erudition.

Mr. Winchell's rise to a position of authority as a geologist was rapid and his career was a most brilliant example of American achievement and of that success which it commands.

Notwithstanding the great pressure of business matters, Mr. Winchell found time to give of his best to a publication of technical papers in the scientific journals devoted to geology and kindred subjects. He also recently had a large part in the preliminary work incident to the drafting of the proposed new mining law which is still under the consideration of Congress. He had done field work not alone extensively in this country but in Mexico, China, Alaska, and Russia. In 1917 he was called to the last-named country by Nicholas II, to make a report of the mineral properties of the Czar in the Caucasus region. This work was interrupted by the Kerensky revolution, which, with Mrs. Winchell, he witnessed in Petrograd.

Mr. Winchell was elected President of the A.I.M.E. in 1919, being succeeded in that office by Herbert Hoover. He was also a fellow of the A.A.A.S., and the Geological Society of America, and a member and councilor of the Society of Economic Geologists, a member of the Montana Society of Engineers, the Minnesota Academy of Science, the British Federated Institution of Mining Engineers and the British Institution of Mining and Metallurgy.

Mr. Winchell is survived by his mother, Mrs. Newton H. Winchell; three sisters—Mrs. U. S. Grant, of Evanston, Ill.; Mrs. Ima Winchell Stacy, of Philadelphia; and Mrs. D. Draper Dayton, of Minneapolis—and a brother, Prof. Alexander Winchell, of Madison, Wis.

A review of Horace V. Winchell's life and work was published in the *Journal-Press* of May 27, 1922, on page 926.

John Callahan, one of the original locators of the Callahan mine, in the Coeur d'Alene district, Idaho, died in Spokane, Wash., on July 17. He was a brother of the late James F. Callahan, the other locator of the mine, and they owned it up to the consolidation with the Interstate Mining Co. Mr. Callahan was born in Benton, Wis., in 1852. He came to the Coeur d'Alenes in 1884, joining the stampede following the discovery of gold on Prichard Creek, and from that time to his death was actively identified with mining in the district.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

SENATE Commission of Gold and Silver Inquiry is conducting an investigation of government silver exchange transactions.

Hecla making plans to rebuild surface plant.

Ontario may shorten period of assessment work.

Railroad project has for its object the tapping of parts of Colorado and New Mexico.

Saskatchewan's "blue-sky" law is contested.

Report on Michigan copper area expected soon.

Fire at Granby plant causes brief shutdown.

Prospectors in British Columbia advised to stay close to railroads.

Dredges active in Colombia.

Sinaloa Exploration & Development Co. in difficulties with the law.

Eureka-Victoria near Hope, B. C., to be reopened.

Reopening gold mines in Germany.

Anaconda reduces smelting charges.

Phœnix to have new railroad.

Glode and Miami to have main-line rail rates.

To Develop an Ichthyol Deposit

Potranca Company Sinking Shaft on Texas Farm Near San Antonio

The Potranca Development Co., Inc., recently formed by twenty San Antonio merchants, began work late in July sinking a shaft on the farm of Frank P. Carle, 18 miles west of San Antonio, Tex., to develop a deposit of ichthyol, said by Mr. Carle to have been discovered while boring for water. The shaft will be of one compartment, and hoisting will be done for the present with a whim. Later, should the deposit prove as extensive as is hoped by the promoters of the enterprise, a gasoline hoist probably will be installed. J. P. Brink, of San Antonio, has the contract for sinking the shaft to depth of 135 ft., to be completed in sixty days.

In addition to ichthyol, a valuable mineral used principally in medicines, material taken from the drill hole has been examined carefully and shows traces of silica, pyrites, and minerals never before encountered in Bexar County. Because of unusual geological formations, more than ordinary interest attends the operations of the company.

Reopening German Gold Mines

During the month of June operations were resumed in the old gold mines situated in the former principality of Waldeck, Germany, where in former centuries gold mining was active.

An abstract from a report just published by the president of the Waldeck Geological Institute follows:

"The gold deposits in Waldeck have not been operated since 1585. The reason for this stagnation is chiefly due to the extraordinarily fine distribution of the otherwise abundantly existing precious metal in a reddish clay, the treatment of which by the old methods of washing and amalgamation encountered great difficulties, causing enormous losses, up to 70 per cent. The fact that the Eder River and its tributaries, starting at the Eisenberg (Iron Mountain) near the town of Corbach, are, on a length of more than 25 kilometers, rich in auriferous ores, certainly warrants the intensive exploitation of this district. Analyses made by the Geological Institute have shown that up to 40 gm. of gold may be obtained per ton."

Anaconda Procures Supply of Coeur d'Alene Zinc

The most encouraging move in connection with the zinc situation in the Coeur d'Alene district, Idaho, is the closing of a contract by the Success Mining Co., for the sale of its zinc product to the Anaconda company for treatment at the electrolytic reduction plant at Great Falls. The Success company has a large accumulation of zinc concentrates, which will be shipped at once. Representatives of Anaconda were recently in the district and stated that the Great Falls plant was not receiving the usual tonnage from Butte mines, which made it possible to take on a limited amount of high-grade zinc ore and concentrates from other sections, and that the Coeur d'Alene district is the most favorably situated field. Although a large amount of zinc is available in the Coeur d'Alenes, practically no shipments have been made except by the Callahan Zinc-Lead Co. and the Federal Mining & Smelting Co. (Morning mine). The Bunker Hill & Sullivan is preparing to erect an electrolytic zinc plant at Kellogg, primarily for the treatment of the zinc product of the Star mine, and which is expected to eventually provide a local market for all Coeur d'Alene zinc.

Court Stops Stock Sales

Officers of Sinaloa Exploration and Development Co. Forbidden to Make Additional Offerings

On the evening of July 26, at a meeting of officers and stockholders in the Hotel Astor, New York City, the Sinaloa Exploration & Development Co., Inc., and its agents were served with a restraining order preventing them from selling any more stock in their gold-mining enterprise. The order was issued by Supreme Court Justice Bijur, and interrupted a meeting held for the purpose of raising stock subscriptions to the amount of $700,000. The order stated that the court was satisfied that the promotor "had resorted to fraudulent practices" in the sale or offer for sale of approximately $700,000 worth of stock. An application to continue the injunction is returnable July 30.

It is alleged that statements concerning the financial condition of the company are false and that the company paid a dividend to the stockholders out of a liability created by the Sinaloa Exploration & Development Co. A payment of dividends to stockholders not out of surplus is a violation of the penal law in New York State. It is also charged that the advertisements used by the company to further the sale of its stock were misleading and fraudulent.

Anaconda Reducing Smelting Charges

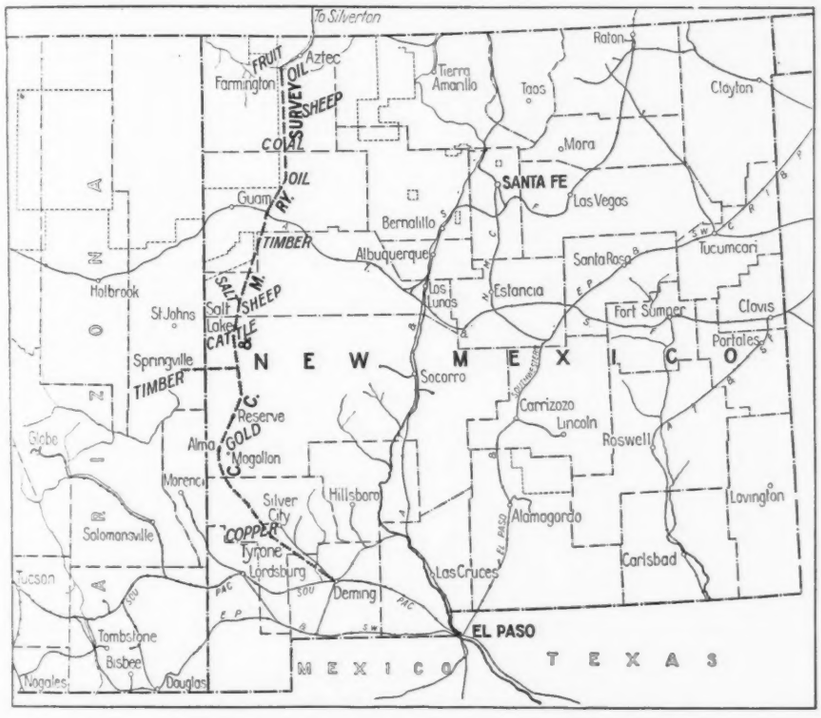
The Anaconda Copper Mining Co. has reduced smelting charge on gold and silver ores and on copper ores containing over 5 per cent copper to $6.50 a ton, from $7.50.

It is understood that treatment charges upon zinc ores may also soon be reduced somewhat.

Railroad Proposed to Tap Parts of Colorado and New Mexico

Project Has Development of a Rich Area for Its Object—Extensive Salt Deposit at Catron

THE building of a railroad to run north from Deming to Farmington, N. M., a distance of 350 miles, through a rich but virgin territory, has been agitated frequently since 1907. In that year the Colorado, Columbus & Mexico R.R. was incorporated. The company made a survey, filed maps, secured some right of way, and, lacking capital, died. The charter has changed hands several times since then, and the project is again showing some activity. On July 24 the State Corporation Commission began holding sessions to hear delegates from the various sections of Utah, Colorado, and New Mexico that might be benefited by the building of this road. The commission intends to answer the protest of the Atchison, Topeka & Santa Fe R.R., which complains that the proposed road will invade its trade territory. The opening of this undeveloped empire, rich in natural resources, would mean much to the mining industry of the southwest.



Map of New Mexico, showing proposed railroad

The route as surveyed will start from Deming, N. M., and follow a course almost due north, passing through Tyrone, Alma, and Reserve, the county seat of the new county of Catron. It will cross the great San Augustine plains, via Salt Lake, Ramah, cross the main line of the Santa Fe at Guam, thence by Seven Lakes and Pueblo Bonita to Farmington, on the San Juan River. It is contemplated that ultimately the road will be extended to Salt Lake City. This course will take the road through the copper country surrounding Tyrone, the agricultural and cattle country on the upper Gila River, the rich Mogollon mining country, now sadly in need of adequate transportation; through the greatest stock country in New Mexico, the San Augustine plains, and past Salt Lake, which Professor Fayette A. Jones, formerly state geologist and now geologist for this company, describes as the most wonderful and interesting salt deposit in the world. The line will also tap the extensive timber resources of the Zuñi Mountains. The shallow oil deposits at Seven Lakes, in McKinley County, cross the eastern edge of the Gallup-Durango coal area, and for the present terminate at Farmington, in the rich San Juan valley, where an oil field of great promise is being developed. It is proposed to furnish an outlet for the rich silver ores of the Silverton Quadrangle to the smelters of the southwest and provide a rail route to that section that will be open for traffic the year round. This route would also furnish a direct connection to the west coast, from which this area has been deprived by its inaccessibility. A branch line is projected from the present survey west to the Springville country, to tap the cattle, sheep, and agricultural resources of this remote section and to open up the big timber areas of the White Mountains.

In speaking of the salt deposit in Catron (formerly Socorro) County, Professor Jones says: "A careful study of this wonderful lake basin proves it to be nothing more than a sunken grave that marks the location of a once active and magnificent volcano. The past geological history of this lake is identically the same as that of Crater Lake, Oregon. This remarkable basin may be described as a circular depression, saucer shaped, 200 ft. deep, and at the center of the depression are two black cinder cones, rising from the basin to a height of 150 ft. One of these cones is solid, but the conduit of the other remains open to a depth of about 18 ft. below the level of the floor of the main basin. In the center of this hollow cone is a circular pool of brine almost to the point of complete saturation. The brine in the conduit rises and percolates through one side of the cone and spreads out in the large saucer-like basin. The water is rapidly evaporated, due to the dry atmosphere, and the salt is deposited on the lake floor. This process of salt making is continuous. Besides the several layers of salt at the bottom of the lake, it is estimated that 500,000 tons of salt are contained in the brine. The deposit is inexhaustible and constantly forming."

Dr. Camsell Advises British Columbia Prospectors to Stay Closer to Railroads

Dr. Charles Camsell, Deputy Minister of Mines for the Dominion, is inspecting mining conditions in British Columbia. His department, he states, is desirous of seeing prospectors direct special attention to mineralized districts adjacent to railways. The tendency is to go too far afield, with the result that nothing but the richest deposits found can be developed. "In the vicinity of the Canadian National, Grand Trunk Pacific (C.N.R.) and C.P.R. lines in British Columbia there is much ground that could be examined by prospectors," he says. "Being close to transportation, bodies of lower-grade ore could be worked profitably, whereas at greater distance they would have no present value."

There are seven parties, Dr. Camsell said, operating under the Canadian Geological Survey in British Columbia and the Yukon and, in addition, two topographical surveys are being conducted, one in the Kootenay Park district and the other in the Babine Range section. Another geological party is making an examination of the Bentonite deposits of the provinces of Alberta and British Columbia.

Dr. Camsell visited Victoria while on the Pacific Coast and conferred with William Sloan, Minister of Mines for the province, on questions relative to British Columbia's interest, from a mining viewpoint, in the Imperial Economic Conference to be held later on this year in London. Charles Stewart, Federal Minister of Mines, and Dr. Camsell both plan to attend this conference.

Hecla Laying Plans for Rebuilding Plant

New and Larger Units To Be Erected in Place of Burned Structure

The Hecla Mining Co., of Wallace, Idaho, whose large surface plant was completely destroyed by fire on July 13, will rebuild as quickly as possible, making the new plant practically fireproof and enlarged to an extent that will meet the requirements of deeper development, and also, so far as hoisting capacity is concerned, to serve the Star mine. This decision was reached at a meeting of the directors called immediately after the fire, by James F. McCarthy, president and general manager of the Hecla company. Though the plant destroyed was modern in every particular, it was necessarily the outgrowth of additions to meet the requirements of expanding operations, and it follows that its arrangement, with the view to convenience and efficiency, can be improved now that all buildings and equipment are to be restored as a unit. Plans are being worked out in the light of experience and when completed it will be a model plant in every particular.

Hecla surface plant before the fire

The work of removing the debris is going on rapidly day and night, and when this has progressed far enough actual construction will begin. All buildings will be of concrete and steel construction. How long it will require to complete the plant and restore the mine to production is difficult to estimate, but it is believed that it will be accomplished well within a year. The determining factor will be the time required to deliver the new hoist.

The depth of the Hecla shaft is now 2,000 ft., and plans were being carried out at the time of the fire which provided for its extension 800 ft. deeper. The new hoist will therefore be equal to the requirements at a depth of upward of 3,000 ft. In addition it must serve the Star mine, owned jointly by the Hecla and Bunker Hill & Sullivan, to which a crosscut is being run from the 2,000 level of the Hecla and which is now nearing completion, its total length being about 9,000 ft.

No official estimate has been made of the value of the Hecla property lost by the fire, but it would probably amount to $500,000 and possibly more. The property was insured for $337,000. The most interesting feature of the company's insurance protection was the "use and occupancy" policy for $1,000,000. As explained by the representative of the insurance companies participating in the policy, this class of insurance is designed solely to indemnify and reimburse for loss sustained by reason of being prevented from occupying, operating and using the plant and machinery destroyed by fire, assuring continuous payment of dividends without drawing on the owner's reserve funds, and to meet all necessary expenses consistent with a condition of idleness, thus indemnifying for losses which would not be covered by ordinary property fire insurance policies. No damage was done to the Hecla shaft or other underground workings, and pumps were started in time to prevent the mine workings from being flooded above the 2,000 level.

Pacific Coast Steel Industry

Local coast papers state that the Pacific Steel Corporation of San Francisco, Calif., is contemplating the construction of a large steel plant at Long Beach, Calif. It is reliably reported that plans for increased activities of the Pacific Steel Corporation are under consideration. The place at which the plant will be constructed will depend upon the outcome of intensive studies being made of the sources of coke and iron-ore supplies in relation to the coast markets. This is being done. It is expected that the Pacific Steel Corporation will develop along the lines now being followed by the Columbia Steel Corporation, which is building a blast furnace and byproduct coking plant at Provo, Utah.

Globe and Miami to Have Main-Line Rail Rates

A recent victory that has been won by the Gila and Graham Counties Traffic Association in the war on rail rates will mean the saving of great sums to the mining industry and residents of the isolated mining camps that are not on the main line of the railroads in Arizona. The decision of the Interstate Commerce Commission directs that Globe and Miami and other points on the Arizona Eastern are to be granted "main-line rates" effective Oct. 11. This will end discriminatory freight rates that have added much to the cost of merchandise and mining supplies at those places, and it is the result of a persistently fought case by the traffic association. The first hearing on the rate arguments were held in Globe before an Interstate Commerce examiner in January, 1922, which resulted in recommendations being made that the reduction of rates be granted. The railroads further appealed and there were other hearings conducted at Phoenix and at Washington. F. A. Jones, of the firm of Jones, Blaine & Jones, of Phoenix, were attorneys for the traffic association. The members of the Graham and Gila Counties Traffic Association is composed of merchants and mining operators of Globe, Miami, and other districts that are situated on the Arizona Eastern R.R.

Clark Gold Mines Converting Power Plant

Tailing and Dumps To Be Treated—New Machinery Being Installed

The Clark Gold Mines Corporation, the new American company which recently acquired the extensive properties of the Montague Gold Fields & Metals Recovery Co., at Montague, N. S., and the Montreal properties at Mount Uniacke, is making rapid progress in conversion of the mining plant at Montague from steam to electrical power. The new power line from Dartmouth to Montague is near completion, and the contractors hope to have it finished by the end of the month. Meanwhile new, up-to-date machinery is being installed for mining and testing the enormous quantity of tailing and dumps on the surface at Montague.

H. M. Clark, the president of the company, is on a visit to Nova Scotia, accompained by his physician, Dr. D. E. Walters, of McKeesport, and they are the guests of E. S. Romilly Smith, general manager of the company, at Montague. Mr. Clark contemplates remaining until completion of the hydro power installation, and is negotiating with people interested in other gold mines in Nova Scotia with a view of development similar to that at the Montague and Mount Uniacke properties.

The new concentrating process, of which the Clark corporation owns the Canadian rights, is being installed for treating the dumps and tailing from

which arsenical concentrates will be recovered. Calculation by experts of the values to be obtained from treatment of the dumps and tailing on the surface of the properties at Montague show the following estimates:

Gold contents of 300,000 tons, producing 12,000 tons of arsenical iron (mispickel) concentrates, assay $70 per ton for gold, and it is estimated will produce $840,000, and the value of the mispickel concentrates, containing 36½ per cent of metallic arsenic at 20c. per lb., is $1,600,000, making a combined value of $2,440,000. This total cut in half for a conservative estimate of gross value of dumps and tailing would be $1,220,000, and allowing $1 per ton for cost of concentrating and $20 per ton for shipping and smelting the 12,000 tons, the cost of treatment is estimated at $300,000, plus $240,000, making a total of $540,000. This taken from the estimated gross value would mean a profit of $680,000.

Simon Silver Makes Its Largest Production

June lead-silver concentrate production by the Simon Silver-Lead Co. was 430 tons, averaging about 60 per cent lead and 40 oz. silver per ton. This was the largest production month in the history of the company. It is estimated that July production will be 500 tons of lead-silver concentrate. About 700 tons of zinc concentrate has accumulated at the mill, no attempt having been made to market this material until the favorable freight rate to Amarillo, Tex., went into effect on July 10. Shipments have now been started and the zinc concentrates will be disposed of at a rate not to exceed 500 tons per month. Mine conditions are said to be good, with plenty of reserve ore in the mine to operate the mill at capacity, about 250 tons per day, for an indefinite time. Development has been slowed down due to shortage of skilled miners, and for this reason no new information is available regarding the very promising orebody discovered several months ago on the 550 level from the new shaft. As soon as conditions warrant this orebody will be prospected for on the upper levels.

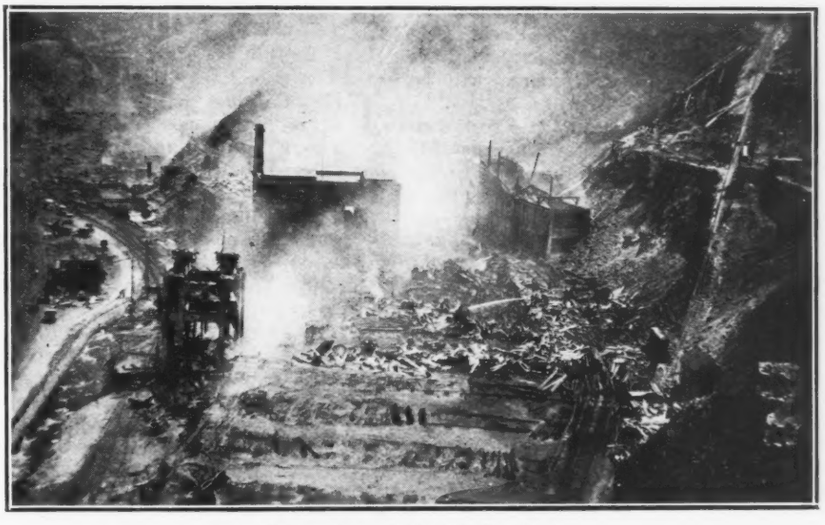
Algoma Iron Deposits May Be Worked

There are indications that Algoma, Ontario, may speedily step into place in the iron-ore field. One of the indications is contained in the visit to Algoma of three leading figures in Chicago's financial life. A visit was paid to the magnetite ore deposits at Mile Sixty, on the Algoma Central Ry. The assay from this range runs as high as 65 per cent iron. It is stated to be low in silica and makes a straight shipping iron, as it needs no treatment whatever. The find is ten miles to the west of the Algoma Central Ry., and if the property is developed it will thus be necessary to build ten miles of railway.

Capital Tight in London, Says Albu

Leopold Albu, managing director of the General Mining & Finance Corporation of London, England, passed through Vancouver, B. C., recently en route to northern British Columbia and Alaskan mining fields. After personally inspecting some mining properties, he will return east via California. In traveling westward Mr. Albu examined some of the larger mines of northern Ontario. His company has extensive mining interests in South Africa, and in speaking of his impressions of this country Mr. Albu said that Canada has all the advantages of South Africa plus the priceless boon of ample water and profuse vegetation.

Capital for the development of mines and other enterprises has become "tight" in London, owing to the uneasy feeling prevailing in England because of the turn of affairs in Continental Europe, Mr. Albu says. This condition was likely to continue until business men obtained a more definite idea of how matters are going to be adjusted. He speaks strongly regarding the policy of France, stating that "France apparently has embarked on a policy more thoroughly imperialistic than that of the Napoleonic era. To business men her actions seem strangely out of tune with the times and she is undoubtedly having an adverse effect on the postwar recovery of England."



The ruins of the Hecla plant

Ontario May Shorten Period for Assessment Work

The new Minister of Mines for Ontario is already taking an active interest in his department, and several changes in the Mining Act are forecast. It is expected that the present period of five years, during which assessment work has to be done on the properties will be shortened, and it is hoped that this will lead to a greater activity in certain sections. Steps will also be taken to insure that there will be, in the future, no sudden forfeitures of patented mining lands for non-payment of the acreage tax. A few years ago a large number of patented properties, on which taxes were not paid, were thrown open for staking. Through lack of proper precaution in the department, there was included in this several mines, among which was the Teck-Hughes, an important producing property. Fortunately, this was discovered at the last moment, and the Teck-Hughes was withdrawn, but it did result in the property being restaked and cost the company considerable money, in addition to producing much confusion and inconvenience.

The department has also under consideration the construction of a railroad into South Lorrain. It is expected that greater publicity will be given to northern Ontario mines, particularly in United States and England, from which it is expected to derive considerable capital.

Dredges Active in Colombia

The McGuire Bros. are operating three hydraulic elevator plants, of which two are on the Porce River, Colombia, South America, and one is on the Rio Grande, a tributory of the Porce. All three operations are successful, as conditions are reported to be good.

Seven gold dredges are in operation in Colombia. The British Platinum & Gold Corporation, Ltd., is operating two and the South American Gold & Platinum Co. three dredges in the Choco district. The Oroville Dredging, Ltd., is operating two dredges on the Nechi River. All of the dredges are doing well, according to information contained in the most recent reports available.

General conditions in Colombia are improving. Petroleum development is favorable and local consumption will be sufficient to absorb production. River steamers burn crude oil, and internal-combustion engines are being largely used for power purposes. Automobiles and trucks are being introduced in greater numbers.

Mining Company May Transfer Highway

Decree Grants Privilege to Expedite Extraction of Iron Ore

Judge Richard C. Flannigan, presiding over the Twelfth judicial circuit of Michigan, this week handed down an important decree in the case of the Rolling Mill Mining Co. vs. the City of Negaunee, and it is a valuable addition to the state's mining law. The case arose when the city gave notice that it was going to improve, widen, and change part of the grade of a highway leading across the mining company's property, about forty feet wide. The company desired to have the road changed to a new location, due to the fact that about 600,000 tons of iron ore underlie the roadway, and the surface is to be caved later on. A temporary injunction was granted by Judge Flannigan, and then arguments made to have the injunction made permanent. The road has been in use for more than fifty years and has been improved several times by the city during that time.

The decree declares that the company can provide a new roadway across another part of the property and pay the expenses of the same, or can let the improvements go ahead and later grant a new highway when the time comes for bringing down the surface. If the change is made now a roadway similar to the one now in use can be provided, but if the improvements are carried through, the road to be built later must be as good as the improved road. No decision has been reached as yet by the company as to which course will be pursued.

Judge Flannigan assumed a very sensible view of the case, stating that the district depended upon the iron ore for its prosperity and that the mining company had the right to remove the ore and bring down the surface. Although the city desired the present right of way for its highway, the mining company has the authority to move it to another location. This is the first time that such a case has been brought to the attention of the courts in Michigan, and it is stated that no appeal will be made to the state supreme court. There are other places in the Michigan field where similar lawsuits might occur, and the decree will have a bearing on all such cases.

Fire at Granby Plant Causes Short Shutdown

A brush fire caused considerable damage to the Granby Consolidated Mining Smelting & Power Co. plant on July 16. The fire started near the coke ovens, where an appreciable quantity of highly inflammable byproducts are stored, and it was only by strenuous efforts on the part of the men that the flames were prevented from reaching this material. The flames then surrounded the powder magazine, the dynamite catching fire, and, ultimately, exploding, without, however, doing any particular damage, other than the destruction of the magazine and the loss of the powder. Fortunately, a good deal of the powder burnt before the explosion occurred. A considerable amount of trestle work was destroyed, cutting off transportation between the mines and the smelter, and, as a consequence, the plant has had to be shut down until the trestles are restored. It is thought that everything will be in full operation again within a week. As yet no estimate of the damage has been announced.

Saskatchewan's "Blue-sky" Law Contested

The Sale of Shares Act, generally known as the "Blue-sky" Law, adopted by the Province of Saskatchewan has been declared *ultra vires* of the Provincial Legislature by the Provincial Court of Appeal, on the ground that it interferes with the powers of companies holding dominion charters and clashes with the authority of the Federal Parliament. This judgment affects similar legislation adopted by the provinces of Ontario, Manitoba, and Alberta, which is modeled on the same lines. The case will probably be appealed to the Supreme Court of Canada.

Dunwell Mine Makes a Find

The recent discovery at the Dunwell mine, on Glacier Creek, a tributary of Bear River, British Columbia, is considered locally to be the most important find in the Portland Canal district since the Premier main vein was opened at depth. The vein is six to eight feet wide and is intersected by a series of cross veins which appear to give rise to oreshoots. It has been ground-sluiced on the surface and opened by two tunnels, the second at a depth of 240 ft. Sufficient work as yet has not been done to determine the size of the shoot in the lower tunnel, but a large body of milling ore has been opened, in which are to be found stringers of shipping ore. If the Granby company decides to develop the George Copper group, at the head of Bear River, and to rehabilitate the Portland Canal Short Line, which, it is understood, is part of the program in the event of the exploration turning out well, the Dunwell mine will be within two miles of the railway, and thus conveniently situated as regards shipping. There are a large number of engineers and speculators at Stewart, and the mining recorder reports that more claims were recorded last month than at any time since the discovery of the Premier orebody.

Geological Investigation of Michigan Copper District Almost Concluded

Research Indicates Magmatic Source of Deposits—Mining to Great Depths Believed Feasible

THE Calumet & Hecla geological survey, the most thorough ever made in the Michigan copper district, has entered upon its final stages after more than three years of research work under the supervision of some of the country's most eminent geologists.

The object throughout has been to determine the origin and sources of native copper and the manner or processes by which it was deposited, with a view to applying the knowledge gained in a practical way in the locating of new deposits. Among other things, it was attempted to find out why copper is present in some stretches of vein matter and absent in others.

The Calumet conglomerate formation is known to be more than 50 miles in length, but there is no commercial value other than in two miles of it, on land owned by Calumet & Hecla. The entire vein has been thoroughly investigated during the years the company has operated upon it, but no values outside of Calumet & Hecla territory have been revealed.

Calumet & Hecla set out to establish, if possible, a set of rules by which the mineralized portion of a lode could be located without wasting millions. The geological survey has been conducted by L. C. Graton, of Harvard, formerly of the U. S. Geological Survey; B. S. Butler, T. W. Broderick, Alfred Wandke, Robert Hoffman, and Charles Palache, mineralogist, of Harvard, and C. P. Hohl, Calumet & Hecla geologist.

Certain conclusions have been reached as a result of the research work so far done. It has been determined to the satisfaction of the geologists that the native copper of the Michigan district came from below, from a deep-lying magmatic source. This is a complete reversal of the theory previously held, and still held by Dr. Alfred C. Land, of Tufts College, formerly State Geologist of Michigan, that the copper came from above, having been leached from the basalts and conglomerates by sea water.

Commercial copper occurs in more or less well-defined shoots, although these may be large. This was brought about, in the opinion of the geologists engaged in the present survey, by thorough-going channels of high permeability or proximity of a barrier of lower permeability inclined diagonally across the channel-way so as to concentrate a greater volume of solution into a given volume of rock. The deposits appear to be unchanged in character or richness from the outcrops to the deepest levels, and it is believed oreshoots of the present grade will be found to continue downward for further long distances.

These conclusions will be found of value, it is believed, in new work. They are particularly encouraging to producing companies with well-defined oreshoots.

To Survey Colorado River

A party of engineers and geologists of the Geological Survey have started from Flagstaff, Ariz., for the Grand Canyon, where they will start a survey of the Colorado River canyons and gorges about Aug. 1. The area to be studied extends from Lee's Ferry to the mouth of the Virginia River, in Arizona, a distance of about 300 miles. Previous surveys have mapped about 1,200 miles of the Colorado and Green rivers, and several hundred miles of their tributaries, and the present undertaking will complete a gap which will make available a continuous river survey from the town of Green River, Wyo., on Green River, and from Grand Junction, Colo., on the Colorado River, to the Mexican boundary.

The party is equipped with four boats of special design, which are to be manned by skilled men who are experienced in negotiating the perilous rapids of the Colorado. The survey is being made to provide data needed for future water developments. The following men compose the party; C. H. Birdseye, chief of party; E. C. LaRue, hydraulic engineer; R. C. Moor, geologist; R. W. Burchard, topographer; E. C. Kolb, head boatman; Lewis R. Freeman, boatman; Leigh Kent, boatman; H. E. Blake, boatman; F. B. Dodge, rodman, and Frank Wood, cook.

Phoenix Soon to Have New Railroad

James S. Douglas said recently that he hopes to have the construction of the railroad from Phoenix to Tucson, which is to be the Phoenix, Tucson & Tidewater R.R., financed and actual work started within six months. This proposed road, of which he is the president, is an independent enterprise, but it is expected that traffic arrangements will be made with the El Paso and Southwestern, which has a dead end at Tucson. This road will also greatly shorten distances from eastern points to Phoenix, and, with the completion of the project to the Pacific Coast, will put Phoenix on a main line road. The route of the proposed road between Tucson and Phoenix was surveyed several years ago, but the work was dropped at the time of the war. The citizens of Phoenix, at a special election, recently granted a right of way through the city streets.

Salt Lake Insecticide Co. Operating Its Plant at Salt Lake City

The Salt Lake Insecticide Co. is operating its recently completed plant at Salt Lake City, and treating forty to fifty tons of scorodite ore (hydrous ferric arsenate) daily shipped from the Western Utah Copper Co. at Cold Hill, Utah, and producing calcium arsenate, which is being shipped out of the state for use in the eradication of the boll weevil pest in the southern cotton fields. From forty to fifty cars of calcium arsenate have been shipped to eastern points since the plant began operation.

News from Washington

By PAUL WOOTON
Special Correspondent

Commission Investigating Government Silver Exchange Transactions

Under Secretary Gilbert Declares They Had No Bearing on Pittman Act Metal

CLOSE SCRUTINY is being given to the disposition made of all silver dollars during the life of the Pittman Act. The Senate Commission of Gold and Silver Inquiry is anxious to secure all the facts concerning shipments of 3,000,000 standard silver dollars to the Orient on Dec. 18, 1919; 7,000,000 dollars on Jan. 23, 1920, and 3,000,000 dollars on Feb. 11, 1920. To get all the facts of this transaction, Under Secretary Gilbert of the Treasury Department was called upon to appear at a hearing to explain this.

Mr. Gilbert declared that these transactions had no bearing on the handling of silver bought on authority of the Pittman Act. It was disclosed at the hearing that the 13,000,000 silver dollars were turned over to the Asia Banking Corporation, to the International Banking Corporation, and to the Park-Union Foreign Banking Corporation to be used in the Orient for the purpose of preventing the price of silver from rising above the point at which the subsidiary coinage of the United States would be exported and to benefit and protect the position of dollar exchange in the Orient.

The hearing developed that the 50,000,000 standard silver dollars which had been removed from the Treasury had been transferred to the Federal Reserve Bank at New York and also had been held in readiness for use in regulating our exchanges with countries having silver monetary standards. The menace to the silver circulation was removed when the price of silver declined from the high point which it had reached on Feb. 11, 1920. Sales of silver were made in San Francisco at prices as high as $1.42 per ounce. The coinage value of silver in the dollar is $1.29 per ounce, and for subsidiary silver coins $1.38 per ounce. It developed, however, that it was not necessary to use the 50,000,000 silver dollars transferred to the Federal Reserve Bank.

At the request of Senator Pittman, Mr. Gilbert furnished a summary of transactions under the Pittman Act up to the close of business July 14. It follows:

Summary of Silver Transactions Up to the Close of Business July 14, 1923, Under the Act Approved April 28, 1918

(Prepared by the Bureau of the Mint)

Items		Dollars	Ounces
Silver (dollars) sold to British Government		259,121,554.00	200,032,325.64
Silver (dollars) allocated for subsidiary coinage		11,111,168.00	8,589,730.13
Silver bullion (purchased) allocated for subsidiary coinage		.....	6,000,000.00
Total allocated		.....	14,589,730.13
Allocations revoked by Secrtary out of bullion purchased	4,341,753.61		
Allocations revoked by authority of Comptroller General (ounces bullion)	10,247,976.52		
Total revocation		.....	14,589,730.13
Silver required to replace dollars melted or broken up		259,121,554.00	(a) 200,418,390.79
Bullion tenders accepted (including margin in excess of legal content required to cover mint operating waste)		.....	200,585,035.00
Bullion deliveries to June 30, 1923 (approximate)		.....	184,383,074.00
Bullion undelivered June 30, 1923 (approximate)		.....	16,201,961.00
Bullion deliveries since June 30, 1923 (estimated)		.....	3,000,000.00
Bullion undelivered this date (estimated)		.....	13,201,961.00

(a) Includes 386,065.15 ounces abrasion and melting loss on coins melted and broken up.

Secretary Gilbert also inserted, as a part of his testimony, the following table:

Standard silver dollar transactions from April 23, 1918, to June 30, 1920, have bedn as follows:		
Dollars melted April 23, 1918, to June 30, 1920		270,121,554
Dollars transferred to Federal Reserve Bank of New York for credit in Treasurer's account		55,000,000
Dollars exported, Nov. 25, 1919, to May 11, 1920	29,287,142	
Probable additional export of dollars, which were separately reported only during the above-mentioned period; at other times included with subsidiary silver coin	1,506,387	
		30,793,529
Net number of dollars released from Treasury stock, April 23, 1918, to June 30, 1920 (on basis of daily statements)		355,915,083
Net withdrawal of silver certificates, April 23, 1918, to June 30, 1920 (on basis of daily statements)		$329,612,722
Net reduction of reserve for Treasury notes of 1890		213,024
Net reduction of free stock of dollars (in general fund)		26,089,337
Total		$355,915,083

Senator Oddie, the chairman of the commission, and Senator Pittman, the vice-chairman, have gone West to make arrangements for the conference in Reno of silver producers. In the meantime, the commission's experts will continue their investigations of Treasury accounts and will compile the large amount of statistical data which the commission must have at hand before it sits again in Washington.

Report To Be Issued on Oxygenated Air in Blast Furnace Work

Spurred by the knowledge that their German competitors are working actively on the application of oxygenated air to metallurgical processes, the industry in this country is making insistent demands upon the government for research work in that connection. It long has been known that in the production of one ton of pig iron three tons of inert nitrogen pass through the furnace. This is true to a more or less extent in all furnace operations where the heat is derived from the conbustion of fuel by atmospheric air.

An exhaustive report on the subject made by a committee representing interested industries, headed by M. H. Roberts, of the Franklin Railway Supply Co., will be made public within a few days. It is understood that this report will show in a conclusive way that the use of oxygenated air in blast furnaces will permit the use of lower-grade materials and make possible a material reduction in the cost of resulting metals.

The plan for this work was the conception of F. G. Cottrell, but no opportunity was offered during his tenure of the office of director of the Bureau of Mines to put the plan into effect. This was done, however, by Dorsey A. Lyon in his capacity as chief metallurgist of the Bureau. F. W. Davis made the metallurgical calculations. These calculations have been checked carefully by Mr. Roberts' advisory committee, which challenges anyone to find a mistake in them.

News from Mining Districts

By Special Correspondence in the Field

BRITISH COLUMBIA

Shipments to Trail Smelter

During the first week of July 9,756 tons of ore was shipped to the Trail Smelter, Consolidated Mining & Smelting Co. The shipments in detail follow:

	Tonnage
Alamo, Alamo, B. C.	47
Bell, Beaverdell, B. C.	43
Bosum, Silverton, B. C.	35
Company Mines, B. C.	9,103
Granite, Taghum, B. C.	3
Hercules, Burke, Idaho	111
Knob Hill, Republic, Wash.	54
Monitor, Three Forks, B. C.	15
Mountain Chief, North Denver	28
Quilp, Republic, Wash.	54
Ruth, Sandon, B. C.	43
Silversmith, Sandon, B. C.	173
Van Roi, Silverton, B. C.	47
	9,756

Eureka-Victoria Being Reopened

The Eureka-Victoria, a silver bearing property situated near Hope, B. C., is being reopened by A. S. Williamson and associates. This is the first metalliferous mine of which there is record in British Columbia. More than half a century ago it was closed down after operating successfully for some years. A tunnel was driven in the mountain side by the old-timers on a rich silver vein, and ore carrying high values was extracted. It was "mule-packed" down the Fraser River, shipped to Victoria, thence to San Francisco, and finally to England. When the returns were received, amounting, it is said, to several hundreds of thousands of dollars, one of the owners went to Victoria to celebrate and never returned. The owners continued work for a time, but disagreements arose and the workings were deserted. Mr. Williamson says that conditions have been found just as they were left, bunkhouse, cookhouse, rusted picks, shovels, and drills and a dump of ore, not rich enough to pay for handling in the old days but of value today. The tunnel timbers have rotted, of course, but with their renewal it will be possible to proceed with work where it was left off by the miners of the last century.

Cork Province Drifting

Drifting is in progress on the new orebody struck in the Cork Province mine, and the mill is to be operated sixteen hours a day. Two carloads of concentrates have been produced, containing about 60 per cent lead and 40 to 45 oz. of silver to the ton.

Placers Exhausted in Yukon?

Captain George Black, M. P., discussing mining conditions in the Yukon Territory, which district he represents in the Dominion House of Commons, said that the placer industry was practically worked out, but that silver mining was in its infancy. Two big aggregations already had invested heavily, and other capital was going in this year to his certain knowledge. Transportation companies, which handled 9,000 tons from Mayo this spring, were preparing to handle 25,000 tons next year. The government was putting in wireless stations at Mayo and Dawson and building roads to the mines. The White Pass & Yukon Ry. was investing largely in the work of damming up of the lakes which feed the Yukon River, in order that water may be so released as to maintain an even flow for navigation.

ONTARIO

South Lorrain Development Satisfactory

Development of the Mining Corporation properties in South Lorrain, Ontario, continues to be eminently satisfactory, and there is a strong possibility that the South Lorrain properties will permit the company to resume dividend payments. So far, stoping has only been carried on in one shoot of ore, and from this stope and the ore recovered from development work, the company has realized enough to pay for the properties and also to pay for all the work to date, amounting to about $750,000. A new shaft has been sunk to a depth of 550 ft., and two new levels will be opened up. So far little work has been done below 300 ft., but it is expected that within two months the new levels will be producing. The company is also sinking a shaft on the Trout Lake property, and some silver has been encountered at a comparatively shallow depth. There is a possibility that an extension of the Nipissing Central Electric Ry. may now be built into South Lorrain, and if this is done the ore will be hauled to Cobalt for treatment. The Cobalt mill has a capacity of 300 tons a day, and is treating the ore from the cleaning up of the Cobalt property and is also handling the La Rose production. If a railroad is built, it will probably mean that the present mill will continue operations. Otherwise, when the ore from the Cobalt properties is exhausted, this mill would have to be scrapped and a smaller plant built in South Lorrain.

Gold Strike in Matachewan

Important discoveries of gold are reported to have been made in the Matachewan gold area by R. J. Jowsey, who was one of the discoverers of the Keeley mine, in South Lorrain. Thirty-two claims have been staked, on which there are three porphyry dikes, in which visible gold is stated to have been found in fifteen different places. Owing to the large number of porphyry dikes in the Matachewan area, the discovery creates much interest.

CALIFORNIA

Thompson Smelter Improvements Await Lower Rail Rates

San Francisco Correspondence

The vital influence of railroad freight rates on mining and smelting operations is emphasized in the situation that has arisen in respect to the Thompson smelter, contiguous to the Mason Valley copper-mining district in Nevada. Contemplated improvements at the smelter are held in abeyance until a more favorable freight rate between the Plumas County copper district and Thompson can be obtained. If such rates can be secured the copper concentrates of that district can be treated at the smelter instead of being hauled to Garfield, Utah. If the Thompson plant can secure the Plumas country concentrates, more ore can be mined at Mason Valley and the activity of that dormant locality revived. Nevadans are especially desirous of bringing this about, and recently Governor Schrugham and E. D. Boyle, president of the Reno Chamber of Commerce, made strong representations to officials of the Southern Pacific and the Western Pacific railroads. The situation is now up to the carriers.

Four Dredges at Work

The Estabrook gold dredge is now handling over 400,000 cu.yd. per month and is reported to be giving satisfactory results. The dredge was started up late in 1922 and has continued up to the present with excellent prospects of completing the year. Three other dredges, the Lewiston, the Trinity, and the Gardella, are also in operation on the Trinity River. Ore production will be started at Iron Mountain, Shasta County, during August.

Grass Valley Prospecting

Milling has been resumed at the Brunswick, local reports stating that 20 stamps are being operated, two shifts per day. Milling is about to start at the Alcalde. The shaft of the Grass Valley Gold Mines, on Alta Hill, is down to a depth of 270 ft. and has intersected quartz stringers that are considered promising. Encouraging results are reported from new development under way in the North Star. The Empire is dropping 80 stamps, three shifts per day. Development is in progress at the Big Ben Consolidated prospects between Lincoln and Grass Valley. A deposit of barite is being tested at the Spanish mine, near tested at the Spanish mine, which is situated near Graniteville, in Nevada County.

Mother Lode Region Reported Moderately Active

The Argonaut is now dropping 40 stamps; 120 men are employed. No trace of the remains of William Fessel has been found. The Kennedy is operating 20 stamps. The property of the Old Eureka mine, near Sutter Creek, has been sold at auction to W. S. Harper, of Brooklyn, N. Y. The Calaveras Copper Co. has put one section of its concentration mill in operation and will soon have the mill in full operation. Construction work is being completed upon the converter building. Blast-furnace smelting will be started soon. More men are being employed as operations at the property are gradually extended.

Labor Situation Slightly Better

The labor situation has improved in spots. In Nevada more or less curtailment due to diminished silver prices has resulted in a greater number of miners. Miners have also arrived from eastern localities. For the first time since operations were commenced the United Comstock has a full mine crew at Gold Hill. Labor conditions are normal at Grass Valley. In northern California and in the Mother Lode conditions are not so happy. The Kennedy mine, which is now operating 20 stamps and will increase this number as rapidly as possible, has raised wages 50c. per day. The wage now being paid is $4.50 for miners and $4 for shovelers. About 200 will be employed at this mine. Labor turnover continues to be large at other mines, but is beginning to show signs of improvement.

NEVADA

Tonopah Belmont May Close Mill

Operations in the Tonopah mining district are rapidly becoming adjusted to conditions existing as a result of the recent and sudden drop of 35c. per oz. in the obtainable price for silver. It appears certain that unless favorable developments occur within a short time, the Tonopah Belmont will close down its mill. In fact, eastern orders to prepare for closing were received early in July, and shippers were notified, but there appears to be a little uncertainty as to when the order takes effect. The mine is to continue to operate on partial basis, shipping the ore to a custom mill. The Tonopah Mining Co. will continue to operate its Millers plant on its own and custom ore. The West End will accept a limited tonnage of custom ore, filling in necessary tonnage from the West End mine so as to keep the mill operating at capacity. The Tonopah Extension continues to operate as formerly. Production figures for July are not yet available, but there is no doubt that they will show a substantial reduction.

To Resume at Speculator Group

Work will soon be resumed on the Speculator group of claims, in the eastern portion of the Goldfield district, about 6 miles from the town of Goldfield. This group was recently purchased from Tom Keane by the Kewanas company. Surface equipment is in place and shaft sinking is to be resumed below the 50-ft. point, which is the present bottom. Surface indications are promising, gold pannings can be obtained and formation is satisfactory. This new work will be watched with interest by Goldfield people, as it is regarded as a promising prospect and one which could easily prove to be a foundation for another boom for Goldfield.

Rochester Silver Makes Final Clean-up

The Rochester Silver Corporation made its final clean-up of the mill on July 10. The clean-up amounted to 15,661 oz. of bullion and represented results of operations during the last fifteen days of June and the first ten days of July, during which time only a part of the property was operated. The mine and mill have been leased to former members of the operating staff, including the general superintendent, the mill superintendent, and the mine foreman. They are prepared to do selective mining on known and developed orebodies, some limited development work, and will sublease certain portions of the mine. Net profits will be divided equally between the company and lessees.

Prince Consolidated Trying to Raise Funds

Production has decreased in the Pioche district, and greater attention is being given to the development of the properties that have been pushing production prior to the termination of the Pittman Act. At the Bristol Silver Mines the management has decided to lease the upper workings, and already three leases have been granted and work begun. The shaft will be sunk 100 ft. and lateral work also done on the lower levels. Only such ore as will be taken out by leasers and that taken out in the progress of development work will be shipped.

The Virginia Louise mine is still shipping steadily, an average of 200 tons daily being sent out. The Prince Consolidated is again trying to raise money for deep development work. The stockholders will be asked to pay an assessment on their holdings of possibly 1c. per share. The last accident which caused the mine to be again flooded has upset the plans of the company, and an earnest effort will once more be made to get the work going again and definitely prove up the mine at depth. The Godbe interests, of Salt Lake City, are in control of the company.

Shipments for the week ending July 27 were 1,250 tons of crude ore shipped to smelters in the Salt Lake Valley and to Colorado. It is hoped that the smelters will consider a further reduction in the treatment charges on the ores of the Pioche district which are favorable for treatment and so increase their tonnage and profits in spite of the curtailment of output caused by the cessation of the production of siliceous silver ore and low-grade siliceous lead-silver ores.

IDAHO

Unity Gold Installing Power Plant

The Unity Gold Mines Co., operating near the old placer camp of Warrens, in Idaho County, is installing a hydroelectric plant on Elk Creek, a tributary of the south fork of the Salmon River, at a reported cost of $200,000. The power will be used partly by the company in its operations and by the mines of the vicinity. The plant will be in operation this fall.

Harmon & Morrow Property Purchased

The Harmon & Morrow gold property, in the Ten Mile district, near Elk City, has been purchased by people of Tacoma, Wash., for a consideration of $35,000. The location is one of the oldest in the district.

Bunker Hill Busy in Wood River District

The Wood River and Little Smoky districts, near Hailey, Idaho, are the scenes of unusual activity this season. Many independent operators are looking over the district with a view of bonding promising properties. The Federal Mining & Smelting Co. is sinking a shaft on the Wood River group, consisting of the Independence and North Star claims, and the Bunker Hill & Sullivan Mining, Concentrating & Power Co. is exploring at depth two of the oldest mining properties in the district.

Strike in Sidney Property

Four feet of high-grade ore has been found in the lower tunnel on the Sidney property on Pine Creek, in the Coeur d'Alenes. Three feet of ore in a high-grade zinc product and a foot of galena is in the vein. This marks one of the most important strikes of the year in the Pine Creek district.

The ore was encountered in a crosscut from the lower tunnel at a face depth of some 70 ft. below the surface workings.

Clarinda Cuts Miller Orebody

The Clarinda Copper Mining Co.'s tunnel No. 5, which has been following the course of the vein for the last 250 ft., at the 1,817-ft. point cut into the Miller orebody. The orebody is full width of the tunnel and offsets squarely into the footwall.

Considerably more work will be required to determine the result. The quartz has been growing more mineralized with every round of shots, and the samples from the 1,817-ft. point indicate something rich just ahead. The same Miller orebody in No. 3 tunnel 500 ft. above the present working yielded assays in gold and silver of over $32. The orebody at that level was 4½ ft. wide and 147 ft. long.

The Clarinda has just taken over the Copper King group, and is taking some good ore from the shaft from a depth of 40 ft. The ore is showing marked improvement as it goes down. It carries copper and silver and is apparently of shipping class.

COLORADO

Many Colorado Silver Miners to Attend Reno Conference

Colorado will send a strong delegation to the meeting of silver producers which has been called by the Senate Commission of Gold and Silver Inquiry to convene at Reno Sept 4.

A meeting of the allied mining organizations of the state will be called early in August to arrange for the selection of a representative delegation comprising a group of the principal silver producers.

The Colorado delegation it is believed will strongly favor the proposition to organize a silver export association, if such an organization is legal under existing laws, or to consider future legislation that will validate such a combination. It is thought that such an association would render great assistance in the production of silver in all of the Americas, would facilitate marketing to meet seasonal demands, and prevent unfair and detrimental control over the price.

The delegation will also probably support a movement to secure a court hearing on the silver purchases of the Treasury Department under the Pittman Act, to ascertain the legality of a cancellation of an allocation of silver for subsidiary coinage, which resulted in the scaling down of the amount of silver to be purchased under the act by something over 10,000,000 oz.

WASHINGTON

Gladstone, Black Rock, and Other Mines Active

The Gladstone mine, in Stevens County, continues to open up new reserves of ore, the latest being the 200 level of the No. 1 chimney, and several carloads of high-grade lead ore are going forward to the smelter each week. The Santa Rita, near Springdale, is turning out five tons of high-grade lead-silver concentrates daily.

The Silver Mountain Consolidated Co., west of Addy, is rushing work on a 50-ton concentrator. The Black Rock mine, near Northport, is building a transmission line from Northport 6 miles for more power. The Keystone group, on Red Mountain, is exploring that property, and several new ore-shoots have been uncovered recently. The Republic district is very active, with the Quilp, Last Chance, Surprise, Knob Hill, and Lone Pine mines shipping steadily to Trail smelter. In the Oroville section the Pyrargyrite mine has joined the list of shippers to the Bunker Hill smelter.

UTAH

Ore Shipments by Utah Mining Camps

For the week ended July 14, 1923 ore shipments were as follows:

Park City shipped 3,860 tons, compared with 3,645 the week preceding. Shippers were: Park City Mining & Smelting, 1,621 tons; Silver King Coalition, 1,024 tons; Park Utah, 390 tons.

Bingham shipped 67 cars of ore. Shippers were: United States Mines, 41 cars; Utah Apex, 14 cars; Montana Bingham, 4 cars.

Eureka shipped 144 cars of ore, compared with 102 cars the week preceding, when the output was low owing to the Fourth of July recess. Shippers were: Chief Consolidated, 43 cars; Tintic Standard, 34 cars; Victoria, 11 cars; Dragon, 10 cars; Iron King, 6 cars; Eagle & Blue Bell, 4 cars; Iron Blossom, 3 cars; Colorado, 1 car; Plutus, 1 car; Bullion Beck, 1 car. The Chief also shipped 5 cars of limestone, 1 car of burnt lime, and 23 cars of road gravel.

MICHIGAN

Copper Range Has 50 Per Cent Maximum Labor Force

Copper Range Consolidated, in the Michigan copper district, which has 50 per cent of a maximum labor force, is now producing approximately 2,400,000 lb. of refined copper per month. Only the Champion mill is in operation, stamping 2,700 tons of rock daily. Four and one-half stamp heads are in use. Under the handicap of labor shortage, Copper Range tonnage is considered a splendid performance, reflecting efficiency in underground operations. Development work is not being neglected in either Champion, Baltic, or Trimountain, and the character of new ground opened is fully on a par with that now being mined. The yield is averaging 37 lb. to the ton.

Seneca Has Choice of Mills

It has not been announced which mill Seneca, in the Michigan copper country, will use when regular production is started. Seneca owns two heads in the Contennial-Allouez plant at Point Mills, but as yet no overhauling has been done. It is a six-head mill, has been idle for three years, and repairs are necessary. It is possible Seneca will not use this plant at this time and that stamping facilities will be obtained in some mill now running. The majority of the operating mills in the Michigan district have available milling space. Seneca rock, taken out during the course of development, is being stamped at the Champion mill, and this arrangement may be continued. Rapid progress is being made in development work at the Gratiot branch of Seneca. Five drifts are being driven, and of these the 11th and 13th are available for stoping. The ground to the south, in the direction of Mohawk, is well charged with copper.

Franklin Rushing Shaft Work

Franklin, in the Michigan copper district, is using a day and night force in sinking its new shaft on the Kearsarge vein. The shaft is still in the overburden and is being timbered as it is lowered. A compressor is to be installed, so that rapid progress can be made when the lode is entered.

Arcadian Consolidated Drifting at Depth

Arcadian Consolidated has started drifting on the 1,250 level in the New Arcadian shaft, this shaft having been dewatered to below that point. Two drifts are now under way, the first being the 960 level, north toward the New Baltic shaft. This opening is breasted in heavy copper, similar in character to the corresponding drift from New Baltic shaft south. This leads to the belief that the intervening ground is equally rich. It is expected that the dewatering of the New Arcadian shaft will be completed within a few weeks. It is bottomed at 1,850 ft., and when this point is reached, sinking will be resumed. It is planned to sink to the 3,000 level to open the vein at depth. Sinking and timbering can be carried on at the rate of 125 ft. per month.

QUEBEC

Davies Makes Test Shipment

A test shipment of 1,500 lb. of ore has been sent out from the Davies property, situated on the south side of Pelletier Lake, Rouyn Township. It was taken from across a width of 9 ft. of vein and showed an average of $18 per ton.

Manville Contracts for Mill

The Manville Asbestos Co., of Asbestos, has given out a contract for a mill at a cost of $100,000, the company supplying all the material.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
26	14.25@14.375	38.125	38.75	6.30	6.40	6.20
27	14.25@14.375	38.25	38.875	6.50	6.50@6.60	6.20@6.35
28	14.25@14.375	38.25	38.75	6.50	6.55@6.60	6.25@6.35
30	14.25@14.375	38.25	38.75	6.55	6.55@6.60	6.30@6.40
31	14.25	38.00	38.625	6.55	6.60	6.25@6.35
Aug. 1	14.25	37.875	38.375	6.55	6.60	6.20@6.30
Av.	14.292	38.125	38.688	6.492	6.550	6.279

*These prices correspond to the following quotations for copper delivered: July 26th to 30, inc., 14.50@14.625c.; 31st and Aug. 1st, 14.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
26	65¼	66	72½	183⅝	184⅝	24	24⅛	30⅝	30⅜
27	65½	66¼	72½	184⅜	185¼	24⅛	24⅛	31	30⅞
30	65⅝	66⅜	72¼	184⅞	185⅞	24⅛	24¼	31⅛	31½
31	65¼	66	72¼	184¾	185½	24⅜	24½	31¾	31½
Aug. 1	64⅞	65⅝	72	183¾	184¼	24⅜	24¼	31⅜	31⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London	July	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London
26	4.59⅜	63	30⅞	89s 8d	30	4.57½	62½	30¾	90s 0d
27	4.58⅝	62⅞	30 13/16	89s 8d	31	4.56¼	62⅝	30⅞	90s 2d
28	4.58	62⅝	30 13/16	.....	Aug. 1	4.56¾	62⅝	30⅞	90s 0d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Average Metal Prices for July

Copper:	
New York Electrolytic	14.321
London Standard	65.278
London Electrolytic	72.364
Lead:	
New York	6.237
St. Louis	6.126
London	24.188
Silver:	
New York, foreign	63.015
London	30.923
Sterling Exchange	458.025
Zinc:	
St. Louis	6.089
London	29.335
Tin:	
99 per cent	37.970
Straits	38.490
London	181.188
Antimony	7.097
Quicksilver	66.980
Platinum	116.000

Metal Markets

New York, Aug. 1, 1923

Lead has been in active demand at advancing prices during the week, but the market for the other non-ferrous metals has been quiet. Antimony has registered a definite advance.

Copper

Most of the producers would be willing to meet the market if attractive business were obtainable, but the lack of all interest by consumers continues, and nothing would be gained by cutting prices. Quotations are nominally 14⅝@14¾c., delivered, but the business at these levels has been confined to a few carloads. Small buyers are urging shipment, but there are not many of them. Two or three lots of about 500 tons each have been sold during the week, but it was necessary to reduce prices below the general level to obtain even this modest business. Today copper was sold for near-by delivery points as low as 14⅜c., delivered. An attractive inquiry for 5,000,000 lb. from the Western Union Telegraph Co. evoked considerable competition.

Foreign business has been rather better than domestic, and better prices have been obtained, about 14.60c. f.a.s. being realized.

Lead

On Friday, July 27, the American Smelting & Refining Co. advanced its official price of lead from 6.25 to 6.50c., New York.

The lead position is very tight. A good tonnage has been sold on the New York basis during the week, but consumers were not in all instances able to fill their requirements at the prices quoted. Ever since the last advance by the Smelting company, speculative interests have been in the market and have paid up to 6.75c. for August and September shipments. For deliveries within the next week or two, prices as high as 7c. have been realized on an occasional carload, such is the scarcity of spot lead. Conditions in both the New York and St. Louis markets may be summed up by the statement that a great deal more lead could be sold at the prices we quote were it available, but that business at higher levels has been very small. The market shows indications of rising to London parity.

Zinc

Business was fairly good early in the week, but in the last two days no orders of consequence have been booked. Forward deliveries still command a premium; prompt zinc was sold throughout most of the week at 6.25@6.30c., but substantial tonnages of the metal for shipment as late as October and November were disposed of, these later deliveries bringing as high as 6.40c. New York prices continue 35c. per 100 lb. above those at

St. Louis. High-grade zinc is unchanged at 8@8.50c. delivered in the East. The premium on Brass Special is about 15 points in the St. Louis market owing to the fact that this grade must be made from high-priced Joplin ores.

Tin

The market has been inactive most of the week, and prices have shown little variation. Forward deliveries have sold at about the same prices as spot, though slight discounts were sometimes made.

Arrivals of tin, in long tons: July 24th, Liverpool, 5; 27th, China, 150; Straits, 25; total to July 31, 5,205.

Foreign Exchange

On Tuesday, July 31, cable quotations on francs were 5.84c.; lire, 4.355c.; marks, 1,000,000 to the dollar; and Canadian dollars, 2$\frac{1}{32}$ per cent discount.

Silver

Silver has again showed an easy tendency during the last week, a new low price for the year having been established in New York on the 30th. The decline was checked, however, by small purchases for account of China and the Indian bazaars, and the market closes quiet.

Mexican Dollars.—July 26th, 48; 27th, 48; 28th, 47$\frac{3}{4}$; 30th, 47$\frac{5}{8}$; 31st, 47$\frac{3}{4}$; Aug. 1st, 47$\frac{3}{4}$.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 26@27c. per lb.; 98 per cent, 25@26c. London, 98 per cent, £115 per long ton.

Antimony — Chinese and Japanese brands, 7$\frac{3}{4}$c. W. C. C., 8$\frac{1}{2}$c. Cookson's "C" grade, spot, 10@10$\frac{1}{2}$c. Chinese needle antimony, lump, nominal, 5.50c. per lb. Standard powdered needle antimony (200 mesh), 6@6.50c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.75@8.25c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 4s. 6d.

Cobalt—$3 per lb. for spot. Discounts on contracts. Oxide, $2.10@$2.25. London, 11s. for metal; 9s. for black oxide.

Iridium—$275@$300 per oz.

Magnesium—Sticks, 1$\frac{1}{2}$ in., 99.9 per cent, $1.25 per lb. London quotes 3s. 3d. @4s. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£135. Seems to be improving.

Osmium—Pure, $70 per oz. troy, in Los Angeles.

Palladium—$80@$81 per oz. London, £17, nominal.

Platinum—$116 per oz. London, £25 for manufactured; sponge, £23.

Quicksilver—$66.50 per 75-lb. flask. San Francisco wires $65.35. London, £10.

Radium—$70 per mg. radium content.

[1]**Rhodium**—$4.50@$5 per gram.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 97c.@$1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore, $21 per ton, c.i.f. Atlantic ports. Rhodesian, $23 and New Caledonian, $25.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51$\frac{1}{2}$ per cent iron, $5.70; Mesabi non-bessemer, 51$\frac{1}{2}$ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—40@45c. per long ton unit, seaport, plus duty; chemical ore, plus 82 per cent MnO_2, $75@$80 per gross ton, powdered.

Molybdenum Ore—75c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, $\frac{3}{4}$@1c. per lb. for ore. Rutile, 94 per cent TiO_2, 10c. per lb. for car lots.

Tungsten Ore — Wolframite and scheelite, $8.75@$9.50 per unit of WO_3, for high-grade ore. Chinese ore, $8.50.

[1]**Vanadium Ore**—75c.@$1 per lb. of V_2O_5.

Zircon—$50 per ton.

Zinc and Lead Ore Markets

Joplin, Mo., July 28.—Zinc blende, per ton, high, $39.65; basis 60 per cent zinc, premium, $38@$39; Prime Western, $37@$38; fines and slimes, $37@$35; average settling price, all blende ores, $37.04; calamine, basis 40 per cent zinc, $18@$20.

Lead, high, $80.90; basis 80 per cent lead, $65@$75; average settling price, all lead ores, $72.93 per ton.

Shipments for the week: Blende, 8,750; calamine, 194; lead, 788 tons. Value, all ores the week, $386,130.

Shipments for seven months: Blende, 387,172; calamine, 2,870; lead, 53,533 tons. Value, all ores seven months, $22,042,130.

It was estimated producers would hold production to around 10,000 tons, and they have accomplished more: it is being held around or under 9,000 tons per week, and the weekly purchases are taking all the ore being produced. Lead has advanced $15 per ton the past fortnight. The restriction of output is cutting deep on lead ore.

Platteville, Wis., July 28.—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $70 per ton. Shipments for the week: Blende, 340 tons; lead, none. Shipments for the year: Blende, 19,158; lead, 460 tons. Shipments for the week to separating plants, 1,208 tons, blende.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$300; spinning fibers, $100@$250; magnesia and compressed sheet fiber, $100@$150; shingle stock, $60@$90; paper stock, $35@$40; cement stock, $8@$12; paper fillers, $20—all per short ton, f.o.b. mines, Quebec, Canada. Good demand for crudes and lower grades of fibers. Long fibers not so much in demand. Paper market fairly good but textiles with exception of brake lining slow. Prices are low. Too much price cutting in the industry. Customers taking present commitments, but not buying ahead.

Barytes — Crude, $7@$10 per ton; market firm. Foam A barytes, $28@$30 per ton, f.o.b. St. Louis; natural barytes, $26@$28. Ground white, $15@$18; off-color, $12@$14. Market slightly better than last six weeks.

Bauxite—American, crushed and dried, $5.50@$8.75 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, crushed, $20@$24 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at $6@$9 per metric ton, c.i.f. Atlantic ports, duty paid.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5$\frac{1}{2}$c. per lb.; in bbls., 5$\frac{3}{4}$c. Boric acid, 10$\frac{1}{2}$c.

Chalk—English, extra light, 5c. Domestic light, 4$\frac{1}{2}$@4$\frac{3}{4}$c.; heavy, 3$\frac{1}{2}$@3$\frac{3}{4}$c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6@$8; washed, $8@$9; powdered, $13@$20, f.o.b. Virginia points. Powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered, $45@$50, f.o.b., New York. 1A grade, refined, $15 per ton, Delaware. Market dull.

Diatomaceous Earth—Natural aggregate, $25 per ton; insulating powder, $30; filtration powder, $35; calcined aggregate, $50; f.o.b. plant, California. Steady, heavy demand.

Emery—Turkish and Greek, 6@8c. per lb. American, 4@5c., f.o.b. shipping points, packed in 350 lb. kegs. Supplies plentiful and demand good.

Feldspar—In Maine, No. 1 pottery grade, $19 per ton; market good.

In Connecticut, No. 1 spar, $7.50 per ton; No. 2, $6. Pulverized, from $18@$20 for 160 to 180 mesh to $25 for 200 mesh.

In New York, No. 1 crude, $8 per ton. Market strong.

In North Carolina, No. 1 ground, 140 mesh, $15@$16 per ton. No. 2 ground, 90 to 100 mesh, $10 per ton. No. 1 (less than 10 per cent flint) $6.50@$7; No. 2 (about 25 per cent flint) $5@$6, f.o.b. railroad sidings. Market strong.

No. 1 Canadian ground, $25 per net ton; No. 2 ground, $20, f.o.b. mill. Market good.

Fluorspar—95 per cent CaF_2, 3 per cent SiC_2, $20 per net ton, c.i.f. New York in bond. Washed gravel, 85 per cent and over calcuim fluoride, 5 per cent and under silica, $23.50 per ton, f.o.b. Ill.; acid lump, $42 per ton. Market quiet. Conservative buying of all materials.

Fuller's Earth—16 to 60 mesh, $18 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14.50; 100 mesh and finer, $7.50; f.o.b. Florida mines. Demand fair.

Graphite—Ceylon lump, first quality, 6@6½c. per lb.; chip, 4½@5c.; dust 3½@4c.

Gypsum—Crushed rock, $3@$4.50 per ton. Ground, $3.50@$8.50, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ½ in. and larger, $1.10 @$1.75 per net ton. Agricultural limestone, pulverized, $2.50@$4.50 per net ton, f.o.b. eastern shipping points.

Magnesite—Crude magnesite, $14 per ton; calcined $35@$37, f.o.b. shipping point in California. Market very good.

Dead-burned magnesite in sacks, $40 @$42, Chester, Pa.; in bulk, $32@$34, Chewelah, Wash.

Manjak—Barbados, in 1 to 5 ton lots, grade "C" lump, $330 per short ton; "C" fine, $250; grade "A," $185—all c.i.f. New York.

Mica—Domestic, No. 1 quality, 1½x2 in., 10c. per lb.; 2x2 in., 35c.; 2x3 in., 70c.; 3x3 in., $1.20; 3x4 in., $1.75; 3x5 in., $2.25; 4x6 in., $3.25; scrap, $25 per ton, North Carolina.

Scrap, $22 per ton; washer and disk, $8@$15 per ton, f.o.b. N. H. mill. Market good.

[1]Monazite—Minimum 6 per cent ThO_2, 6@8c. per lb.

Phosphate — 77 to 76 per cent tricalcium phosphate, hard rock, $7.50 per ton, f.o.b. Jacksonville; 77 to 76 per cent pebble grades, $6.75; 75 to 74 per cent pebble, $5.75; 70 per cent pebble, $4.35; 66 to 68 per cent pebble, $3.90, f.o.b. Tampa.

In Tennessee, 65 per cent ground rock, $5.50@$6.50 per ton; 72 per cent washed, unground, $5.50@$6 per long ton; 75 per cent lump, free of fines, $6.25@$7; 78 per cent, lump, $8@$8.50 per long ton. Market slow.

Pumice Stone—Imported lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Imported lump, 1 in. diameter and up, 11½c. per long ton unit; furnace size, 2½ in. diameter, 12c. per long ton unit; fines, through ½-in. mesh, 11½c. per long ton unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent iron.

Silica—Glass sand, $1.50@$3 per ton. Market quiet; 500 mesh, $31; 350 mesh, $25; 200 mesh, $20; 100 mesh, $8; all f.o.b. Illinois plant, water ground and floated for paints and polishes.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Ground talc, 150 to 200 mesh, $6@$8.50 per ton, bags extra, Vermont. Competition keen with offerings below production cost.

Roofing grades, $5@$7.50 per ton; paper grades, $9@$17; Vermont.

Coarse, $6.50; fine, $8@$14 per ton; crayons, $1.20@$2 per gross; Vermont.

White talc, $25 per ton; gray-white, $8; yellow, $9; red, $12; North Carolina.

Grade A, 350 mesh, $22; grade B, 300 mesh, $18; grade C, $12 per ton, f.o.b. New York. Market dull.

Tripoli—Once ground, rose and cream colored, $16@$25; white, $18@$27; double ground, r. and c., $17@$25; w., $19@$30; air-float, r. and c., $25@$30; w., $35; super air-float, r. and c., $35@ $40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri.

Mineral Products

Arsenious Oxide (white arsenic)— 9½@10c. per lb. delivered over balance of year.

Copper Sulphate—Current quotations, 5.25@5.45c. with freight allowed, for domestic material.

Sodium Nitrate—$2.45 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $43.67 per ton.

Sodium Sulphate—$26@$28 per ton, New York.

Ferro-Alloys

[1]Ferrocerium—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 28@30c. per lb.; 4 to 6 per cent carbon, 12c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $117.50 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $45@$47.50, f.o.b. furnace; 16@19 per cent, $44@$46.50.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades. Dull.

Ferrosilicon—10 to 12 per cent, $43 @$50 per gross ton, f.o.b. works; 50 per cent, $77.50 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—85@95c. per lb. of contained W, f.o.b. works. Quiet.

[1]Ferro-uranium—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.50@$4.50 per lb. of V contained, f.o.b. works. Active.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Metal Products

Rolled Copper—Sheets, 22.75@23.75c. wire, 17.50c.

Lead Sheets—Full lead sheets, 10.25c. per lb.; cut lead sheets, 10.50c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 20.75c. per lb.; rods, 17.75c. per lb.

Zinc Sheets—$8.90 per 100 lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$50@$52 per net ton, f.o.b. shipping point.

Firebrick—First quality, $45@$47 per M., Ohio and Kentucky works; $48@$51, Central Pennsylvania; second quality, $41@$43.

Magnesite Brick — 9-in. straights, $65@$68 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$45@$47 per M., Pennsylvania; $53@$55 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

The Iron Trade

Pittsburgh, July 31, 1923

Steel-mill operations have kept up quite well in the last week, there having indeed been no material decrease at the beginning of July. Distributers and consumers having orders at mills are taking deliveries, cancellations or postponements being almost negligible, and there has been, if anything, a slight increase in the last week in specifications on contracts. Though some mills have rather lean order books, they are getting the bulk of such new business as is being placed.

Prices for the leading steel products are fully maintained. The market is under no pressure. August is likely to prove dull, as July has been, but September will bring more business. Whether the increased business will sustain the market or will induce price cutting remains to be seen. At most the market will simply recede, with a disposition to stability at the new level.

Here and there consumption of steel has decreased slightly, but in general the steel consumers are operating well, with at least fair prospects before them.

Pig Iron—There is a little more inquiry and actual buying of foundry iron, as supplies of various consumers run out and hand-to-mouth buying begins. Bessemer and basic, quotable at $26.50 and $25, Valley, respectively, are stagnant. Foundry is $25 to $26, Valley, against $25.50@$26 a week ago.

Connellsville Coke — Furnace and foundry are easier, at $4.50@$5 for furnace and $5.25@$5.75 for foundry. Medium sulphur coke, for heating and miscellaneous purposes, has stiffened sharply, being now $4@$4.25.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1922	1923	1922	1923	1922	1923
January	65.450	65.668	35.035	31.928	421.750	465.053
February	65.290	64.313	33.891	30.875	435.511	468.631
March	64.440	67.556	33.269	32.310	436.912	459.269
April	66.575	66.855	34.080	32.346	440.715	465.220
May	71.154	67.043	36.023	32.611	444.106	462.252
June	71.149	64.861	35.900	31.611	444.615	461.132
July	70.245	63.015	35.644	30.923	444.165	458.025
August	69.417		34.957		446.069	
September	69.515		35.305		442.800	
October	68.015		34.498		443.583	
November	65.177		32.882		447.484	
December	63.905		31.383		460.440	
Year	67.528		34.406		442.346	

New York quotations cents per ounce troy, 999 fine, foreign silver. London pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1922	1923	1922	1923	1922	1923
January	13.465	14.510	65.226	64.494	72.321	71.409
February	12.864	15.355	60.250	67.700	66.125	74.500
March	12.567	16.832	59.245	73.851	65.739	81.464
April	12.573	16.663	58.799	73.169	64.028	81.331
May	13.111	15.440	61.092	67.460	66.554	76.568
June	13.575	14.663	61.988	66.607	69.333	73.239
July	13.654	14.321	63.137	65.278	70.321	72.364
August	13.723		63.784		69.932	
September	13.748		63.113		70.917	
October	13.632		62.773		70.693	
November	13.598		62.795		70.216	
December	14.074		63.267		70.132	
Year	13.382		62.123		68.859	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1922	1923	1922	1923	1922	1923
January	4.700	7.633	4.388	7.571	23.667	27.119
February	4.700	8.050	4.396	8.093	20.681	28.519
March	4.720	8.252	4.421	8.254	21.266	28.815
April	5.115	8.101	4.946	7.996	22.993	26.956
May	5.420	7.306	5.281	7.085	24.462	25.614
June	5.745	7.146	5.563	6.852	24.685	25.429
July	5.729	6.237	5.447	6.126	24.869	24.188
August	5.824		5.537		24.580	
September	6.110		5.868		24.131	
October	6.530		6.338		25.551	
November	7.047		6.868		26.199	
December	7.163		6.978		26.079	
Year	5.734		5.503		24.097	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1922	1923	1922	1923	1922	1923
January	31.480	37.986	32.100	39.173	163.065	181.852
February	29.835	40.693	30.767	42.011	149.850	190.513
March	28.426	46.569	29.171	48.569	143.152	219.607
April	29.810	44.280	30.605	45.810	149.840	213.081
May	30.149	42.346	30.971	43.135	150.163	203.097
June	30.707	40.375	31.497	40.957	152.512	191.798
July	31.025	37.970	31.733	38.490	156.149	181.188
August	32.134		32.380		160.006	
September	32.075		32.395		160.065	
October	33.935		34.600		170.563	
November	35.911		36.734		179.341	
December	36.480		37.695		178.697	
Year	31.831		32.554		159.450	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1922	1923	1922	1923
January	4.691	6.815	26.321	35.733
February	4.485	7.152	24.213	35.613
March	4.658	7.706	25.467	36.720
April	4.906	7.197	26.576	34.275
May	5.110	6.625	27.304	31.057
June	5.346	6.031	27.893	29.548
July	5.694	6.089	29.042	29.335
August	6.212		31.170	
September	6.548		31.750	
October	6.840		34.528	
November	7.104		38.011	
December	6.999		37.757	
Year	5.716		30.003	

St. Louis quotations, cents per pound. London, pounds sterling, per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1922	1923	1922	1923	1922	1923
January	4.463	6.884	49.960	72.731	97.260	112.462
February	4.416	7.290	48.295	70.636	89.545	113.273
March	4.319	8.885	50.204	70.808	87.500	110.846
April	4.980	8.380	52.280	69.200	87.500	116.840
May	5.467	7.477	54.885	68.000	85.529	115.077
June	5.145	6.839	55.115	67.769	87.212	115.615
July	5.091	7.097	55.000	66.980	90.180	116.000
August	5.315		57.593		98.370	
September	6.580		67.640		117.280	
October	6.905		72.560		109.440	
November	6.584		71.521		108.000	
December	6.382		72.300		113.600	
Year	5.471		58.946		97.618	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1922	1923	1922	1923	1922	1923
January	21.55	29.27	20.15	27.35	21.34	28.77
February	21.46	29.79	19.71	28.15	20.88	27.21
March	21.35	32.03	19.96	31.79	20.83	31.77
April	22.50	32.77	21.26	32.77	22.70	32.77
May	26.36	31.87	26.87	29.83	25.96	32.46
June	26.96	30.27	26.96	28.34	25.96	29.81
July	26.77		26.33		25.97	
August	30.44		27.18		30.81	
September	35.27		34.70		36.79	
October	35.27		31.77		33.40	
November	33.52		29.37		30.55	
December	29.87		26.34		27.69	
Year	27.61		25.88		26.91	

In dollars per long ton.

Monthly Crude Copper Production

	1923			
	March	April	May	June
Alaska shipments	4,284,081	6,886,159	8,693,161	7,921,680
Washoe Smelter	20,250,000	19,400,000	18,100,000	18,300,000
Calumet & Arizona	3,506,000	3,520,000	2,868,000	3,548,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	(c)	(c)	(c)	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(c)	(c)	(c)	(c)
Miami	5,310,000	5,017,000	5,557,000	5,702,000
Nevada Cons.	(c)	(c)	(c)	(c)
New Cornelia	3,181,928	3,155,615	3,631,906	3,497,788
Old Dominion	2,530,000	3,271,600	2,187,000	2,285,000
Phelps Dodge	8,767,000	7,668,000	8,947,000	7,965,000
Ray	(c)	(c)	(c)	(c)
Shattuck Arizona	(c)	(c)	(c)	(c)
Southwest Metals Co.	1,122,605	906,982	1,000,000	1,185,385
United Verde	(c)	(c)	(c)	(c)
United Verde Extension	3,621,074	3,759,160	3,759,012	3,517,744
Utah Copper	(c)	(c)	(c)	(c)
Others, estimated	12,500,000	10,500,000	16,000,000	14,900,000
Total United States				
Imports: Ore and concentrates, matte	8,567,487	12,320,004	12,992,447	
Imports of black and blister, unrefined	27,128,296	7,643,962	29,961,531	
Imports of refined and old	18,229,112	17,186,044	38,150,650	
Grand total				
Backus & Johnston	(c)	(c)	(c)	(c)
Boleo	1,302,053	1,519,245	1,389,150	1,484,421
Cananea	(c)	(c)	(c)	(c)
Cerro de Pasco	(c)	(c)	(c)	(c)
Chile	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada	(a)	(a)	(a)	(a)
Falcon Mines		510,000	516,000	
Furukawa	3,233,515	3,023,738	2,634,156	
Granby Cons.	3,251,360	3,217,577	2,771,179	3,199,366
Hampden Cloncurry				
Katanga	8,824,410	8,531,145	9,012,405	10,606,050
Mount Morgan		930,000		
Mount Lyell			1,128,000	
Phelps Dodge Mexican	3,960,000	3,940,000	3,688,000	3,579,000
Sumitomo	2,563,681	2,663,750	2,643,944	3,565,169
Wallaroo & Moonta	354,397	208,026	609,793	

Comparative Monthly Copper Production

	1920	1921	1922	1923
January	121,903,744	90,596,597	32,010,292 (b)	112,341,000
February	117,540,000	86,682,941	45,957,530 (b)	102,641,000
March	120,309,316	91 046,345	55,705,760 (b)	122,202,000
April	116,078,871	46,946,523 (b)	76,601,000 (b)	117,914,000
May	114,964,207	25,310,511 (b)	88,714,000 (b)	124,785,000
June	116,107,856	24,623,693 (b)	93,740,000	
July	109,729,610	22,033,739 (b)	91,000,000	
August	112,460,254	23,248,398 (b)	101,188,000	
September	104,919,562	23,855,316 (b)	96,408,000	
October	105,231,571	23,231,572 (b)	103,273,000	
November	106,700,178	28,341,442 (b)	102,845,000	
December	95,709,009	29,629,137 (b)	03,003,000	

(a) No copper produced during this month. (b) Department of Commerce. (c) Not available

COMPANY REPORTS

International Nickel Co.

Nickel, Copper; Ontario and West Virginia

Earnings of the International Nickel Co. showed an improvement last year, though the fact that the plants were shut down until September interfered with profits. The consolidated general balance sheet for the year ended March 31, 1923, is as follows:

Assets

	1923	1922
Properties owned and operated	$60,506,815	$58,321,527
Written off for dismantlement	2,404,403	286,575
	$58,102,413	$58,034,952
Additions during year less recoveries	2,363,605	2,471,864
	$60,466,018	$60,506,816
Deduct		
Depreciation of plants	6,955,283	8,649,170
Depletion	2,220,542	2,096,591
	$9,175,825	$10,745,761
	$51,290,192	$49,761,055
Investments	571,770	558,485
	$51,861,962	$50,319,540
Current assets		
Inventories	5,657,899	9,340,599
Bills receivable		38,028
Accounts receivable	1,772,128	723,123
Interest receivable	18,169	14,998
Advances	146,019	144,890
Government securities	100,000	100,000
Loans on call (secured)	1,000,000	1,013,000
Cash	1,522,816	756,774
	$62,078,993	$62,450,952

Liabilities

Capital stock		
Preferred 6 per cent non-cumulative	$8,912,600	$8,912,600
Common	41,834,600	41,834,600
	$50,747,200	$50,747,200
Current liabilities		
Accounts payable and pay rolls	587,604	494,846
Taxes accrued	57,645	193,811
Dividends unclaimed	139	153
Preferred dividend of May 1, 1923	133,689	133,689
	$779,076	$822,499
Insurance and contingent fund	516,050	865,413
Surplus, March 31, 1923	10,036,667	10,015,840
	$62,078,993	$62,450,952

The consolidated general profit and loss statement follows:

	1923	1922
Earnings of all properties after deducting manufacturing, selling expenses, ordinary repairs and maintenance	$1,153,322	$373,086
Other income	128,950	234,267
Total income	$1,282,272	$607,353
Administrative and head office expense: including reserves for taxes	435,183	523,749
Net operating income	$847,089	$83,651
Shutdown expense, depreciation and depletion	798,919	881,331
Profit for 1923; loss for 1922	$48,170	$797,747
Surplus, April 1, 1922	$10,015,840	$11,886,177
Profit and loss for year, as above	48,170	797,747
Adjustments of taxes, inventories, and appraisals credit in 1923; debit in 1922	507,413	537,834
	$10,571,423	$10,550,596
Preferred dividends	534,756	534,756
Surplus, March 31, 1923	$10,036,667	$10,015,840

During the year the Orford Works, at Bayonne, N. J., was abandoned and the stocks were transferred to other plants. The electrolytic refining is now all accomplished at the Port Colborne works, near Niagara Falls, in Ontario, where modern equipment of increased capacity has been installed. Electrolytic nickel, for which there is an increasing demand, can now be produced at lower cost, owing to the use of hydro-electric power. A further saving resulting from an increased production of electrolytic nickel is the total recovery of the platinum metals from the matte.

Sales of nickel for the year equaled the pre-war volume of 1910 and the sales of monel metal exceeded those of any year since the alloy was introduced in 1906. Mining was resumed at Creighton on Sept. 12, 1922. This mine has reserves sufficient for twelve years' operation at the present rate of production, and an increase in these reserves is likely. The Copper Cliff smelter was restarted on Sept. 1, 1922, improvements offsetting higher costs of freight and fuel. The Port Colborne refinery has recently been operating at 75 per cent of capacity. The new monel metal rolling mill at Huntington, W. Va., was completed in July and production started in August, 1922. The mill cost $3,690,000.

The preferred dividend was paid at the expense of the surplus, as only $48,170 was earned after allowing $394,728 for depreciation and depletion. No dividend was paid on the common.

Officers are: Robert C. Stanley, president; J. L. Ashley, vice-president, secretary, and treasurer; J. W. Beard, controller. Directors are: J. L. Ashley, Seward Prosser, A. V. Stout, W. E. Corey, W. N. Cromwell, W. T. Graham, Charles Hayden, Alfred Jaretzki, J. L. Agnew, W. W. Mein, Thomas Morrison, Britton Osler, R. C. Stanley. General offices: Bayonne, N. J. Executive and financial department, 67 Wall St., New York City.

The Park City Mining & Smelting Co. Judge Mining & Smelting Co.

Silver, Lead; Park City, Utah

A report of the operations of the Park City Mining & Smelting Co. and Judge Mining & Smelting Co. for 1922 and the first quarter of 1923 shows the following results:

Jan. 1, 1922, to Jan. 1, 1923

Balance Jan. 1, 1922			$148,004.15
Receipts			
Ore sales			
Crude	16,419 tons @ $47.77	$784,365.69	
Leasees	6,238 tons @ 14.88	92,805.45	
Concentrates	7,879 tons @ 43.06	339,275.32	
		$1,216,446.46	
Interest on loans and deposits		11,422.22	
Dividends		3,000.00	
Sundry receipts		5,601.75	
			1,236,470.43
			$1,384,474.58
Disbursements			
Mine account		$355,403.55	
Mill account		66,639.93	
Ore expense		55,647.65	
Prospecting		144,708.30	
Zinc plant		9,269.77	
General			
Engineering, drainage		27,118.69	
Liability and fire insurance		20,676.59	
Taxes and legal		21,750.83	
Office, salaries, rent, reports and stock certificates		24,009.49	
Assessment, New Quincy Mining Co. stock		1,500.00	
		$726,724.80	
Dividend No. 1		87,600.00	
		$814,324.80	
Balance Jan. 1, 1923		570,149.78	
			$1,384,474.58
Assets			
Cash on hand Jan. 1, 1923		$548,221.71	
Secured loans		21,928.07	
			$570,149.78
Bills receivable			
New Quincy Mining Co. note—principal		$30,325.60	
Interest to Jan. 1, 1923		8,875.85	
			$39,201.45
(This note is secured by first mortgage on New Quincy property)			
Stocks			Shares
Park Utah Mining Co.			7,500
Daly Mining Co.			34,000
New Quincy Mining Co.			50,000

Park City and Judge Mining Companies (Continued)

Ore Statement for Year 1922

	Dry Tons
Crude ore sold	22,657
Ore concentrated	33,040
Concentrates sold	7,879

Average Ore Values per Ton

	Dry Tons	Oz. Gold	Oz. Silver	Per Cent Lead	Per Cent Copper	Sold For
Crude ore	22,657	0.032	37.14	15.88	1.37	$38.72
Concentrates	7,879	0.058	33.51	28.11	1.13	43.06

Total Metallic Values for Year

Oz. Gold	Oz. Silver	Lb. Lead	Lb. Copper
1,174.09	1,090,418	11,369,555	789,466

Total Output of Combined Properties to April 1, 1923

	Silver, Oz.	Gold, Oz.	Lead, Lb.	Copper, Lb.	Sold For	Dividends
To 1923	36,707,079	38,688	430,881,617	24,136,208	$36,319,211	$10,568,600
First quarter, 1923	370,732	394	4,350,533	282,755	516,151	109,500
	37,077,811	39,083	435,232,150	24,418,963	$36,835,363	$10,678,100

Consolidated Tabular Financial Statement

Jan., Feb., March, 1923

Balance Jan. 1, 1923			$570,149.78
Receipts			
Ore sales			
Concentrates	2,158 tons @ $55.83	$120,479.47	
Crude	7,602 tons @ 42.66	324,285.04	
Lease ore	1,977 tons @ 20.30	40,135.65	
Zinc	145 tons @ 148.67	21,557.56	
Zinc calcines	294 tons @ 24.04	7,069.09	
Zinc skimmings	40 tons @ 65.62	2,624.96	
			$516,151.77
Interest on loans, bonds and deposits		$4,147.55	
Dividend		1,125.00	
Miscellaneous receipts		1,329.78	
			522,754.10
Expenditures		$233,721.04	
Receipts over expenditures		$289,033.06	
Dividend No. 2		109,500.00	
			179,533.06
Balance April 1, 1923			$749,682.84
Balances, available			
Cash on hand April 1, 1923		$580,324.77	
Secured loans		21,928.07	
Liberty bonds—$150,000.00		147,430.00	
Balance April 1, 1923			$749,682.84

Ontario Silver Mining Co.

Silver, Lead; Summit and Wasatch Counties, Utah

A report of the operations of the Ontario Silver Mining Co. for 1922 shows the following financial results:

Cash, stocks and bonds on hand Jan. 1, 1922		$535,120.96
Receipts		
Ore sales	$293,621.19	
Rents and royalties	19,258.44	
Interest and dividends	20,222.17	
Miscellaneous	7,464.85	340,566.65
		$875,687.61
Disbursements		
Mine labor and salaries	$162,808.03	
Supplies and power	140,116.85	$302,924.88
General expense	$49,271.46	
Tax and insurance	37,812.70	
No. 2 tunnel expense	6,987.62	94,071.78
Assessments New Quincy Mining Co.		2,250.00
		$399,246.66
Cash in bank	$17,029.61	
Bills receivable	36,953.78	
Miscellaneous	2,265.00	
Stocks and bonds	420,192.56	
Cash, stocks and bonds on hand Jan. 1, 1923		476,440.95
		$875,687.61

Miscellaneous holdings are: Four-sevenths interest in Weber Coal Co.; one-third interest in Naildriver Mining Co.; one-third interest in Silver Lake Water Co.; 75,000 shares of New Quincy Mining Co. stock.

Facts for the Stockholder

XXV—Old Dominion Co.

THE OLD DOMINION CO. was incorporated in Maine, Jan. 15, 1904, as a holding company, and acquired the entire capital stock of the United Globe Mines and $3,883,824 of the $4,050,000 outstanding capital stock of the Old Dominion Copper Mining & Smelting Co. In 1917 all of the assets of the latter were acquired, and both of the subsidiaries ceased to be separate operating organizations.

Properties formerly owned by the Old Dominion Copper Mining & Smelting Co. comprise 38 mining claims, 4 placer claims, and 5 mill sites, all patented, including the Old Dominion mine at Globe, the Old Dominion and Keystone properties 3½ miles north of Globe, the Continental property of 240 acres about 18 miles west of Globe, the Chicago and New York group of 60 acres, and the Geneva mine.

The principal ore zone of the Old Dominion mine occurs along a large fault vein, with hanging wall of limestone and quartz and footwall of diabase. Ore occurs near the hanging wall, in lenses along bedding planes of the limestone, and in shattered quartzite. Oxidized ores are chiefly cuprite associated with malachite and chrysocolla in a gangue of quartz and iron oxides. The sulphide ores are chalcocite and chalcopyrite in a gangue of quartz and pyrite. Most of the ore is argentiferous and highly siliceous, with the exception of certain bodies of high-grade smelting ore in the lower levels. Ore reserves are estimated at about 1,200,000 tons averaging about 4 per cent copper. Direct smelting ore averages 7.65 per cent copper.

The mine is opened by several shafts and numerous levels, to a depth of over 1,600 ft., or to the twentieth level. Development work during recent years has been advanced as follows: 24,321 ft. in 1917, 22,163 ft. in 1918, 25,844 ft. in 1919, 31,626 ft. in 1920, 8,434 ft. in 1921, and 16,744 ft. in 1922.

In normal years ore has been extracted at the rate of 200,000 to 250,000 tons annually. The mine and smelter were closed in April, 1921. Mining operations were resumed in February, 1922, and smelting operations in April, 1922. Equipment includes concentration and flotation plant, and smelter with a capacity of over 2,000 tons daily. The smelter does considerable custom work.

Average grade of ore extracted during recent years has been as follows: 4.97 per cent copper in 1917, 4.52 in 1918, 4.28 in 1919, 4.79 in 1920, 5.31 in 1921, and 5.14 per cent in 1922.

Annual production in millions of pounds of refined copper has been as follows: 27.7 in 1911, 28.8 in 1912, 30.3 in 1913, 28.9 in 1914, 25.3 in 1915, 32.5 in 1916, 32.3 in 1917, 33.4 in 1918, 28.2 in 1919, 22.8 in 1920, 7.4 in 1921, and 18.6 in 1922.

Costs per pound of refined copper are estimated as follows: 9.3c. in 1911, 10.7c. in 1912, 10.1c. in 1913, 8.7c. in 1914, 9.9c. in 1915, 12.3c. in 1916, 18.8c. in 1917, 21.2c. in 1918, 18.7c. in 1919, and 18.5c. in 1920. Costs since 1916 include depletion, depreciation and taxes.

Capitalization consists of 350,000 shares, par value $25. There is no funded debt.

Earnings per share are estimated as follows: $2.85 in 1911, $5.50 in 1912, $5.20 in 1913, $4.80 in 1914, $7.32 in 1915, $16.10 in 1916, $4.99 in 1917, $2.03 in 1918, a loss of $1.26 in 1919, a profit of $0.08 in 1920, a loss of $3.99 in 1921, and a loss in 1922.

The dividend record has been as follows: 50c. a share in 1905-6, $1 in 1907, 50c. in 1908, $1.50 in 1909-10-11, $4 in 1912, $5 in 1913, $4 in 1914, $5 in 1915, $12 in 1916, $8 in 1917, $4 in 1918; none since. Last payment was $1 a share, Dec. 31, 1918.

On Dec. 31, 1922, total current assets were $2,142,000, with current liabilities at $1,767,427, leaving net working capital $374,582, equivalent to about 11 per cent of metal sales. Net assets applicable to capital stock estimated at about $27.40 a share.

Price range of stock during last ten years: High, 82¼ in 1916; low, 15 in 1920; closing price, 18, July 3, 1923 (last sale). The shares are listed on the Boston and New York Stock Exchanges.

INVESTIGATOR.

MINING STOCKS

Week Ended July 28, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	61¼	59½	60	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	1½	1½	1½		
Allouez	Boston	*20	*20	*20	Mar. '19	1.00
Anaconda	New York	42⅜	39¼	39⅜	Je. 16, Jy. 23	0.75
Arcadian Consol.	Boston	2⅛	1⅞	1⅞		
Ariz. Com'l	Boston	10⅛	10	10	July '23,	0.50
Calaveras	N. Y. Curb	2	2	2		
Calumet & Arizona	Boston	49	47	47½	June '23,	1.00
Cal. & Hecla (New)	Boston	44½	43	43¼	June '23, Q	10.00
Centennial	Boston			8¼	Dec. '18, SA	1.00
Cerro de Pasco	New York	41⅛	37½	37½	Jy. 19, Au. 1	1.00
Chile Copper	New York	27⅛	26½	26½	Se. 1, Se. 29, Q	0.62½
Chino	New York	20	18½	18½	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	2½	2	2½		
Copper Range	Boston	33¼	31	31	May '23, Q	1.00
Crystal Copper	Boston Curb	*59	*50	*57		
Davis-Daly	Boston	2¾	2¾	2¾	Mar. '20, Q	0.25
East Butte	Boston	6½	6	6	Dec. '19, A	0.50
First National	Boston Curb	35	30	35	Feb. '19, SA	0.15
Franklin	Boston	1¼	1¼	1¼		
Gadsden Copper	Boston Curb	55	50	55		
Granby Consol.	New York	21⅝	19⅜	19⅜	May '19, Q	1.25
Greene-Cananea	New York	19⅜	18	18	Nov. '20, Q	0.50
Hancock	Boston			2½		
Howe Sound	N. Y. Curb	3¼	3⅛	3⅛	Jy. 2, Jy. 16	0.05
Inspiration Consol.	New York	31	28½	28½	Je. 14, Jy. 2 Q	0.50
Iron Cap	Boston Curb	4½	4	4	May 23, K	0.15
Isle Royale	Boston	25½	24	24	June '23, Q	0.50
Kennecott	New York	35⅜	32½	32¾	Je. 8, Jy. 2 Q	0.75
Keweenaw	Boston			*95		
Lake Copper	Boston	2⅛	2	2		
Magma Copper	New York	32½	28⅞	28⅞	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅛		
Mass Consolidated	Boston			1¼	Nov. '17, Q	1.00
Miami Copper	New York	25⅛	23⅜	23⅜	Au. 1, Au. 15, Q	0.50
Michigan	Boston	2⅛	2	2⅛		
Mohawk	Boston	47¼	42½	42½	June '23, Q	1.00
Mother Lode Coa.	New York	9⅛	8⅛	8⅛	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	12⅜	11½	11½	Sept. '20, Q	0.25
New Cornelia	Boston	18½	18½	18½	Au. 3, Au. 20, Q	0.25
North Butte	Boston	3⅜	2½	2½	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*68	*62	*65		
Old Dominion	Boston	21½	20	20	Dec. '18, Q	1.00
Osceola	Boston	31½	31½	31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†155	†165		Je. 20, Jy. 2 Q	1.00
Quincy	Boston	32	28	28	Mar. '20, Q	1.00
Ray Consolidated	New York	11⅞	10⅝	10⅝	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1	*95	1		
St. Mary's Min. Ld.	Boston	36	35	35	Mar. '23, K	3.00
Seneca Copper	New York	8½	8	8¼		
Shannon	Boston	*60	*50	*60	Nov. '17, Q	0.25
Shattuck Arizona	New York	6	6	6	Jan. '20, Q	0.25
South Lake	Boston	*†15		*12		
Superior & Boston	Boston	1¼	1	1		
Tenn. C. & C. cfs	New York	9⅛	9	9	Je. 30, Jy. 16, Q	0.25
Tuolumne	Boston			*14	May '13,	0.10
United Verde Ex.	N. Y. Curb	31⅜	31	31	Jy. 5, Au. 7, Q	1.00
Utah Consol.	Boston			2	Sept '18,	0.25
Utah Copper	New York	60½	58	58	Je. 8, Je. 30, Q	1.00
Utah Metal & T.	Boston	*74	*50	*50	Dec. '17,	0.30
Victoria	Boston	†1	†*75			
Winona	Boston	*85	*75	*75		
Wolverine	Boston	8	7	7		
NICKEL-COPPER						
Internat. Nickel	New York	13⅜	12⅛	12⅛	Mar.' 19,	0.50
Internat. Nickel pfd.	New York	80	80	80	Jy. 19, Au. 1	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			3		
National Lead	New York	118¾	111½	111½	Se.16, Se.29 Q	2.00
National Lead pfd.	New York	111½	110⅛	111½	Au. 24, Se. 15 Q	1.75
St. Joseph Lead	New York	18½	18	18⅛	Se.9, Se.20 Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	10	9⅛	9⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	32	32	32	Nov. '20, Q	1.50
Butte C. & Z.	New York	6½	6	6	Mar. '23,	0.50
Butte & Superior	New York	22	19	19	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	6½	6	6½	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	154	152	152½	Jy. 31, Au. 10 Q	2.00
United Zinc	N. Y. Curb			*80		
Yellow Pine	Los Angeles	*60	*60	*60	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb	3½	3½	3½		
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*35	*33⅓	*33⅓	May '20, K	0.03
Candelaria	N. Y. Curb	*7	*6	*6		
Castle-Trethewey	Toronto	*27	*26	*26		
Coniagas	Toronto	2.70	2.70	2.70	May '21, Q	0.12½
Crown Reserve	Toronto	*61	*59	*61	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	*92	*23	*25		
Kerr Lake	N. Y. Curb	2½	2½	2½	Jy. 2, Jy. 16, Q	0.12½
La Rose	Toronto	*34	*33½	*33½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*18	*17½	*17½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.25	2.05	2.25	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5¼	5⅛	5⅛	Jy. 1, Jy. 20 Q	0.15
Ontario Silver	New York			3	Jan. '19, Q	0.50
Temiskaming	Toronto	*38	*37	*38	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	¼	¼	¼		
Alaska Juneau	New York	1	1	1		
Boundary Red M.	N. Y. Curb			*15		
Carson Hill	Boston	6	6	6		
Cresson Consol. G.	N. Y. Curb	3½	3 5/16	3 1/16	Apr. '23 Q	0 10
Dome Mines	New York	36¼	35	35	Je.30, Jy.20 Q	1.00
Golden Cycle	Colo. Springs	1.08½	1.07	1.07	Dec. '22, Q	0 02
Hollinger Consol.	Toronto	12.35	12.10	12.10	Jy.26, Au.13 M	0.05
Homestake Mining	New York			63	Jy.20, Jy.25 M	0.50
Kirkland Lake	Toronto	*35	*34	*34		
Lake Shore	Toronto	3.39	3.35	3.35	May '23, Q	0.02
McIntyre-Porcupine	New York	17	16	16	Au.1, Se.1, Q	0.25
Portland	Colo. Springs	*35	*35	*35	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 1/16	1¼	1¼		
Tom Reed	Los Angeles	*47	*40	*40	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅜	1⅜	1⅜	Jy. '28, Q	0.15
Vipond Cons.	Toronto	*68½	*65	*68		
Wright-Hargreaves	Toronto	3.15	3.10	3.10	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1½	1½	1½	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb			*14		
Con. Cortez	N. Y. Curb	*68	*66	*68		
Con. Virginia	San Francisco	9½	9½	9½		
Continental Mines	N. Y. Curb	5⅜	5	5		
Dolores Esperanza	N. Y. Curb	1½	1 15/16	1 15/16	Jy. 1, Jy. 10 Q	0.05
Jib Consol.	N. Y. Curb			*70		
Tonopah Belmont	N. Y. Curb	*75	*70	*70	Apr. '23, Q	0 05
Tonopah Divide	N. Y. Curb	*55	*50	*50	May 23	0.10
Tonopah Extension	N. Y. Curb	1⅞	1⅜	1⅜	Je. 9, Jy. 2	0.05
Tonopah Mining	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	3⅛	3	3⅛		
West End Consol.	N. Y. Curb	*82	*78	*81	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	16	16	16	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*58	*58	*58	Dec. '20,	0.15
Chief Consol.	Boston Curb	3⅜	3⅓	3⅜	Au. 1, '23, Q	0.10
Columbus Rexall	Salt Lake	*44	*43	*43	Aug. '22,	0.03
Consol. M. & S.	Montreal	25¼	25	25	Oct. '20, Q	0.62½
Erupcion	Boston Curb	3	2⅞	3	Apr. '23, Q	0.125
Federal M. & S.	New York	8	8	8	Jan. '09,	1.50
Federal M. & S. pfd.	New York	39¼	38	38	June '23, Q	1.75
Florence Silver	Spokane			*38	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	7⅛	6⅞	7⅛	Je. 15 Q	0.50
Iron Blossom Con.	N. Y. Curb	*24	*23	*24	July 16,	0.02½
Marsh Mines	N. Y. Curb			*6	June '21, I	0.02
Park City	Salt Lake			3.25	Je.15, Jy.2 Q	0.12½
Park Utah	N. Y. Curb	3	2⅞	2⅞	Je.15, Jy.2 Q	0.15
Prince Consol.	Salt Lake	*1⅛	*1⅛	*1⅛	Nov. '17,	0.02½
Silversmith	Spokane			*38	Jy. 2, Jy. 10	0.02
Simon Silver-Lead	N. Y. Curb	*25	*25	*25		
Snowstorm Silver-L.	N. Y. Curb			*43		
Tamarack-Custer	Spokane			1.25	Je.30, K	0.02
Tintic Standard	Salt Lake	2.97½	2.95	2.95	July '23	0.15
Utah-Apex	Boston	3⅛	3	3	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	49⅜	45⅞	46	Se. 1, Oc. 1 Q	1.25
Char. Iron	Detroit	1	1	1		
Char. Iron pfd.	Detroit			1¾		
Colorado Fuel & Iron	New York	28¾	25	25¾	May '23, Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	29⅜	26⅜	26⅜	Apr. '23	1.00
Inland Steel	N. Y. Curb			46½	June '23 Q	0.62½
Mesabi Iron	N. Y. Curb			7		
Replogle Steel	New York	14½	10⅜	10⅜		
Republic I. & S.	New York	46⅞	42	42	May '21	1.50
Republic I. S. pfd.	New York	93	93	93	Se.15, Oc.1 Q	3.75
Sloss-Sheffield S. & I.	New York	46½	43½	43⅜	Feb. '21	1.50
Sloss-Shef. S. & I. pfd.	New York	†84	†75	78	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	92⅜	86½	86⅞	Je.29, Q	1.25
U. S. Steel pfd.	New York	118	117⅝	118	May '23	1.75
Virginia I. C. & C.	New York	55	55	55	Je.16, Jy. 2	2.00
Virginia I.C.&C.pfd.	New York	78½	78¼	78½	Je.16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	31½	26	26½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	53	52	53	Je.30, Jy.15 Q	1.50
Asbestos Corp. pfd.	Montreal			75	Je.30, Jy.15 Q	1.75
SULPHUR						
Freeport Texas	New York	12½	10	10½	Nov. '19, Q	1.00
Texas Gulf	New York	58½	56½	56½	June '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅞	3½	3½		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	45	42¼	42¼	Au. 20, Se. 1	0.75
Amer. Metal pfd.	New York	110	110	110	Au. 18, Se. 1	1.75
Amer. Sm. & Ref.	New York	58½	54½	54½	Jy. 9, Au. 1	1.25
Amer. Sm. & Ref. pfd	New York	96½	95½	95½	Au. 10, Se. 1 Q	1.75
U. S. Sm R. & M.	New York	27½	22½	22½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	†43½	†42	41½	Jy. 6, Jy. 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

INDUSTRIAL NOTES

Buying Mining Machinery

Right of Purchaser to Rely Upon Seller's Representations as to Fitness for Desired Purposes

By Leslie Childs

THE question of the right of a buyer of mining machinery to rely upon the representations of the seller as to the fitness of the machinery for the purposes for which it was bought is obviously one of importance to mining engineers, owners, and operators in general. The point has been the subject of considerable litigation, but as each case of the kind has necessarily been decided in the light of the particular facts and circumstances involved, it can hardly be covered by the statement of a hard and fast rule.

However, generally speaking, it seems that the buyer of machinery, in such a situation, has no right to rely upon the representations of the seller as to its fitness for the purposes intended, unless the seller warrants or contracts to that effect. The application of this rule of law to a situation of this kind is illustrated in an interesting and instructive manner in — — Drill Co. vs. Mallory *et al.*, 137 Fed. 332. The facts and circumstances which culminated in the action were, in so far as material to this article, as follows:

Mallory was engaged in prospecting for coal in Lucas County, Iowa. In this work he had been using a diamond drill, but objected to it because it frequently failed to produce a core, as the coal was soft and the diameter of the drill only 1 in. He was then on the outlook for a drill that would produce a larger core, and at the same time enable him to drill without increased cost, when he had his attention called to the drills manufactured by the drill company that was defendant in the action above noted.

Contract for Purchase of Drill Entered Into

Mallory, through his agent Haven, who it appears was in charge of affairs, went to the drill company's place of business and there saw the latter's drill in operation with a shot bit. Haven then described the strata through which a drill must pass in boring upon the land of his employer, Mallory, and explained that he wanted a drill that would produce a larger core, and at the same time operate as cheaply and rapidly as the diamond drill he had been using. The drill company, it seems, informed him that its machine was just the drill he wanted; "That it would operate as economically and as rapidly as a diamond drill, and would get a larger core." Haven thereupon purchased a drill of the company, which was described in the latter's catalog as a "Class F 3 drill," along with certain machinery, tools and articles, for the sum of $2,459. This drill and equipment was thereafter delivered, according to the contract, upon the property of Mallory in Iowa, but upon trial, it appears, it failed to operate to the satisfaction of the latter. A dispute followed, which culminated in the instant action by the drill company for the price of the drill and equipment.

At this point it may be noted that the drill and equipment purchased was not manufactured especially for Mallory. The outfit, it appears, was carried by the drill company in stock and specifically listed in its catalog. Further, in the contract of purchase, the drill company did not in any way warrant the fitness of the drill for the purpose intended by Mallory, and the drill did, it seems, meet every requirement of a drill of its class.

However, Mallory, in defense to the instant action, sought to show that there was an implied warranty of the fitness of the equipment for his particular purpose, the contention being that as the drill company had been informed of the character of strata to be bored through, it impliedly warranted the fitness of its drill by recommending it for the purpose. The trial of the cause in the lower court resulted in a judgment in favor of Mallory. From this judgment the drill company prosecuted an appeal to the higher court, where, in stating the rule relative to when there will be an implied warranty of fitness for the purpose intended of an article, it was, in part, said:

"An implied warranty that an article will be fit for a particular purpose may be inferred from a contract to make or supply it to accomplish that purpose, because the accomplishment of the purpose is the essence of the undertaking. . . .

"But no implied warranty of a machine, tool or article suitable to accomplish a particular purpose or to do a specific work arises when the vendee orders of the manufacturer, or purchases of the dealer, a specific, described, or definite machine, tool, or article, although the vendor knows the purpose or work which the purchaser intends to accomplish with it, and assures him that it will effect it. Such assurance is but the expression of an opinion, when it is followed by a written contract, complete in itself, which is silent upon the subject. The extent of the implied warranty in such a case is that the machine, tool, or article shall correspond with the description or exemplar, and that it shall be suitable to perform the ordinary work which the described machine is made to do. . . . "

Following the above statement of the general rule in situations of this kind, and the finding that there was no evidence that the drill furnished was not in accordance with the contract and would not perform the ordinary work it was designed to perform, the court directed its attention to the application of the rule announced to the facts of the instant case. In this connection it was, among other things, said:

"The contract of the — — Drill Co. in this case was expressed in writing. It was that it would make and deliver to the purchaser, Mallory, one class F 3 drill, and certain other machines and articles, which were definitely specified in the contract. When it supplied these articles, it performed its agreement, whether they were suitable to perform the specific work of boring holes in the land controlled by the vendee in Lucas County, Iowa, or not. . . ."

In conclusion, the higher court reversed the judgment rendered in the lower court in favor of Mallory and ordered the case back for a new trial, holding, in effect, as outlined in the opinion, that there had been no implied warranty of the fitness of the drill to bore holes in the land of Mallory in Iowa, and that as the drill had been supplied in accordance with the contract, the drill company was entitled to recover.

The foregoing decision was well reasoned and its holding is without doubt in accord with the great weight of authority upon the question decided. In the light of this holding it is obvious that the buyer of machinery should not ordinarily rely upon the bare statement of the seller as to the fitness of machinery for the purpose purchased, for as a general rule such statements will not constitute a warranty on this subject. If the buyer intends that the seller shall warrant the fitness of machinery for the purpose purchased, the contract of sale should bear this out or contain an express warranty to that effect. Otherwise, as we have seen, when the seller has furnished machinery in compliance with the terms of the contract, the buyer must take the risk of it fulfilling his requirements, and if it fails, the loss, if any, must fall on him. Truly, then, the case reviewed is one of value on the point decided, and one well worth the having in mind by every mining executive when entering into contracts similar to the one involved in the case reviewed.

Burford, Hall & Smith, American Trust and Savings Bank Building, Birmingham, Ala., have been appointed district representatives for the sale of Diamond soot blowers by the Diamond Power Specialty Corporation, of Detroit. The appointment of Paul E. Theis as sales manager of the Cleveland district, with offices at 608 Rockefeller Building, has also been announced. The Boiler Equipment Service Co., Candler Building, Atlanta, Ga., is now selling Diamond soot blowers in Georgia and Florida, having been appointed district representatives by the Diamond Power company.

The International Diamond Drill Contracting Co., of San Francisco, has the contract for diamond drilling at the Mammoth mine and the Balaklala mine, in Shasta County, Calif.

The Commercial Indian Agency of Lahore, Punjab, India, is desirous of establishing agency connections for all kinds of machinery and other merchandise.